American Aviation

Flying test bed:
Boeing B-47 with IROQUOIS

FOR A WELL-DEFENDED FUTURE...

IROQUOIS

ORENDA'S SUPERSONIC TURBOJET

ORENDA

ENGINES LIMITED

MALTON, CANADA

MEMBER: A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP

3 YEARS AND OVER 200 INSTALLATIONS LAT

The first unit of the Wilcox VOR was shipped three years ago. Since then the number of Wilcox VOR installations, in use at both military and commercial airports, here and abroad, has grown to over 200.

Why this universal acceptance? Because the Wilcox VOR has so many outstanding advantages. In fact here are seven reasons why Wilcox VOR is the unrivaled leader in the field:

ONLY **wilcox** has the slot-type antenna with no rotating parts which makes possible full dual installation of all critical components.

ONLY **wilcox** has an antenna that is prefabricated, lightweight, shipped as a package for fast, efficient field erection.

ONLY **wilcox** can achieve constant 1800 rpm signal rotation in countries using 50 or 60 cycle stable frequency power by merely changing one pulley, no other modification necessary.

ONLY **wilcox** has an advanced type of modulation eliminator which does not waste RF power, present problems of maintaining bridge circuit balance, or employ special type vacuum tubes.

ONLY **wilcox** has complete remote control over one pair of wires; as compared to the usual three.

ONLY **wilcox** has an electronic FM sub carrier generator that eliminates the difficu and precise maintenance procedures require on earlier type tone-wheel mechanisms.

ONLY **wilcox VOR** provides these un matched performance characteristics at lo cost for the installation of such facilities.

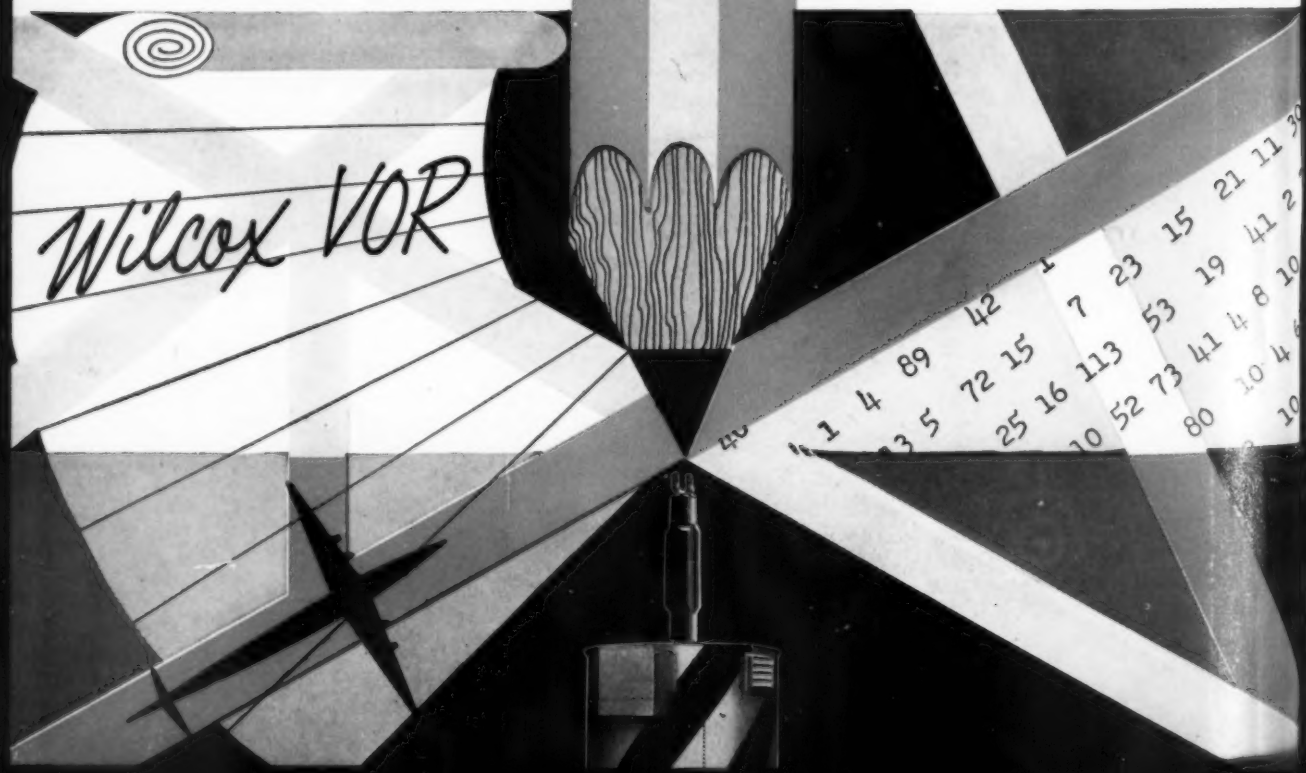
Let Wilcox VOR be your Low Cos Answer to . . . increased regularity o operation . . . increased ability to handl traffic . . . increased safety.

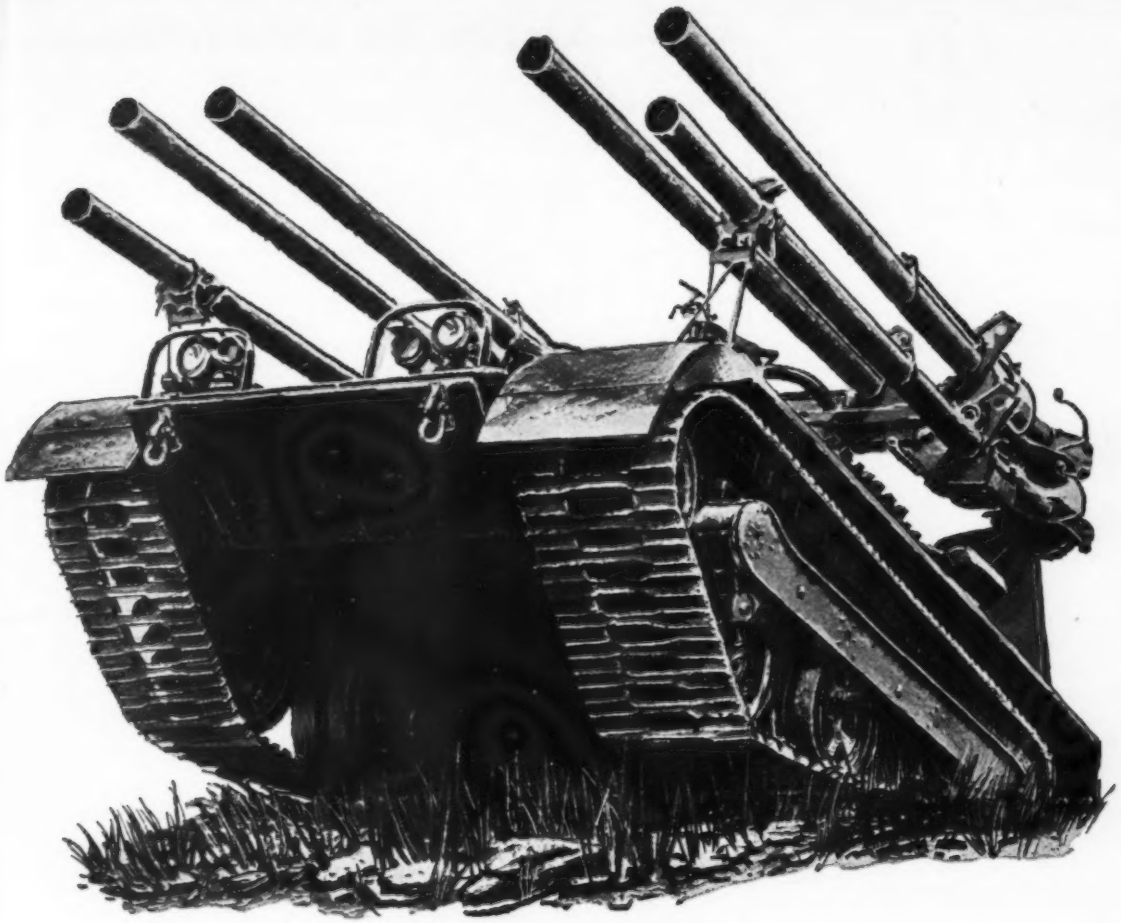
Who uses Wilcox VOR? That's easy! Just abou everyone—including: U. S. Signal Corps Arm Aviation; U. S. Air Force; U. S. Navy; Pa American World Airways System, Trans Worl Airlines; Air France; Dow Chemical Compan Governments of Belgium, Chile, Colombia Norway, Finland, Sweden, Canada; the State of Kentucky, Nebraska, and Minnesota an many others.

WANT COMPLETE INFORMATION ON LOW-COST VO INCLUDING TECHNICAL DATA? WRITE, WIRE OR PHO TODAY . . .

wilcox

ELECTRIC COMPANY, INC.
Fourteenth and Chestnut
Kansas City 27, Missouri, U.S.A.





"ONTOS"! land-bound fighter with airplane-type fuel cells

Low, lean and lethal — this is the "Ontos," new land combat vehicle of the U. S. Marine Corps, with more firepower than any other in history.

Highly maneuverable, it is a hit-run weapon which relies upon its low silhouette to get in, strike and get out fast.

This low silhouette is made possible, in part, through an airplane-type fuel cell — built by Goodyear Aviation Products—which is "tunneled" so that the vehicle's drive shaft runs right through it.

By utilizing bladder cells and aircraft-type fittings to replace conventional rigid metal-tank construction — fuel-tank bounce, vibration and corrosion problems are eliminated.

Produced by Allis-Chalmers at its La Porte, Indiana, Works, the Ontos gets its name from the Greek for "the Thing." And what a thing it is: a multi-purpose combat vehicle that does the work of twelve — a feat made possible partly by aeronautical pioneering.

Goodyear Aviation Products Division is a leader in the field of fuel cells, for aircraft, boats, guided missiles and vehicles. For full information, write: Goodyear, Aviation Products Division, Dept. B-1713 Akron 16, Ohio, and Los Angeles 54, California.

GOODYEAR AVIATION PRODUCTS

Circle No. 1 on Reader Service Card.

SAVE 10 LBS.*

specify hi-shears

In weight comparison between HI-SHEARS and high strength close tolerance bolts, per thousand pieces and using a ¼" diameter—⅜ grip length—4650 lbs. shear, the bolt-nut-washer weight is almost double that of HI-SHEARS.

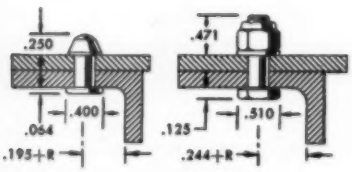
HS52P-8-6	Steel Hi-Shear Pin.....	9.25
HS15-8	Alum. Hi-Shear Collar....	1.32

10.57 lbs.

NAS464P4A7	Steel Bolt	17.35
AN365D428	Alum. Nut	3.40
AN960PD416L	Alum. Washer	.90

21.65 lbs.

Even substituting a 40% lighter titanium bolt for the steel bolt, the bolt-nut-washer combination is still heavier than the HI-SHEAR by 4.14 lbs. per thousand pieces.



Substantial weight savings are also gained by the use of smaller fittings through reduced clearances required by HI-SHEARS.

Write for additional HI-SHEAR data

U.S. and foreign patents — Trademark registered.

hi-shear RIVET TOOL COMPANY
3001 WEST 247TH STREET · TORRANCE · CALIFORNIA

Circle No. 2 on Reader Service Card.

AMERICAN AVIATION

Voice of the Industry Since 1937

Editorial Offices: 1001 Vermont Ave., N.W., Washington 5, D. C., USA. Phone: Sterling 3-5400. Cable: AMERAV.

Advertising Offices: 17 East 48th Street, New York 17, N. Y., USA. Phone: Templeton 8-5446.

WAYNE W. PARRISH, *Editor and Publisher*

ROBERT H. WOOD, *Editorial Director*

ALBERT W. BENTZ, *Managing Editor*

ERIC BRAMLEY, *News Editor* — JOSEPH S. MURPHY, *Technical Editor*

DEPARTMENT EDITORS

WILLIAM V. HENZEY, *Transport*
HENRY T. SIMMONS, *Military*
KEITH SAUNDERS, *News Analysis*
ANTHONY VANDYK, *International*
HENRY P. STEIER, *Electronics Engineering*
WILLIAM BELLER, *Aero Engineering*
SEABROOK HULL, *Aerophysics*
ERIK BERGAUST, *Missile Engineering*
CHARLES SCHAEFFER, *Congress*
LOIS C. PHILMUS, *Business Aircraft*
FRED S. HUNTER, *West Coast*
SELIG ALTSCHUL, *Contributing Financial*
S. P. SAINT, *Contributing*
WALLACE I. LONGSTRETH, *Cargo*
MARY L. MILLER, *Rates & Tariffs*
WILLIAM H. MARTIN, *Art*
BERNARD BROWN, *Copy Desk*
JOHN WALEN, *Production*
JEAN-MARIE RICHE, *Paris*
JAMES H. STEVENS, *London*
ARTHUR J. NEWFIELD, *Research Director*

LEONARD EISERER, *General Manager*

WILLIAM H. PEARSON, *Director of Advertising*

BUSINESS OFFICE

Larry Brettner, Circulation Director; Geneva C. Kinnaird, Circulation Fulfillment Manager; Ellen P. Coakley, Advertising Service Manager.

REGIONAL OFFICES

New York City: 17 East 48th St., New York 17, N. Y. William H. Pearson, director of advertising; Edward D. Muhlfeld, assistant director of advertising; M. Michael Cerick, Paul Kinney, and Robert Weston, regional advertising managers. Phone TEmpleton 8-5446.
West Coast: 8943 Wilshire Boulevard, Beverly Hills, Calif., Fred S. Hunter, manager; John Ball, Jr., and Walton E. Brown, Regional advertising managers. Phone: Bradshaw 2-6561, and Crestview 6-6605.
Canada: Allin Associates, 12 Richmond Street, East Toronto, Ontario. Phone: Empire 4-2001. Allin Associates, 2226 Dorchester Street West, Montreal, Quebec.
Chicago: 139 N. Clark St., Chicago 2, Ill., Laurie S. Seward, regional advertising manager. Phone: Central 6-5804.
Dallas: 4924 Greenville Avenue, Dallas 6, Texas. Phone: EMerson 1-4507. Richard A. Worthington, Regional advertising manager.
Detroit: 201 Stephenson Bldg., Detroit 2, Mich. Phone TRinity 5-2555. Kenneth J. Wells, regional advertising manager.
Cleveland: Hanna Bldg., Room 1046, 1422 Euclid Avenue, Cleveland, Ohio. Phone PRospect 1-2420. Douglas H. Boynton, regional advertising manager.
London: The AAP Company, 17 Drayton Road, Boreham Wood, Hertfordshire, England. Phone: ELStree 2688. Cable Address: STEVAIR, London.
Paris: Jean-Marie Riche, 1: Rue Condorcet, Paris (9e) France. Phone: TRU 15-39.

PUBLISHING INFORMATION

Published: Every other Monday by American Aviation Publications Inc., Washington, D. C. Printed at The Telegraph Press, Harrisburg, Pa. Entered as Second Class Matter in Washington and Harrisburg.
Subscription Rates: For U.S. and Canada—$5.00 for 1 year; $8.00 for 2 years. Other countries—$7.00 for 1 year; $12.00 for 2 years. Subscription limited to aviation industry personnel.
Incorporates: Airports and Air Carriers; Aviation Equipment, The American Pilot; Aviation Sales & Service; U.S. Aviation; and American Airports. All rights to these names are reserved.
Change of Address: Send old address (exactly as it appears on mailing label on your copy of magazine) and new address, including zone number if any, to American Aviation, 1001 Vermont Avenue, N.W. Washington 5, D. C. Allow two weeks for changeover.

PUBLISHING CORPORATION

American Aviation Publications Inc.: Principal offices at 1001 Vermont Ave., N.W., Washington 5, D. C. Wayne W. Parrish, president; Leonard Eiserer, executive vice president and general manager; William H. Pearson, vice president and director of advertising; Albert H. Stackpole and Eric Bramley, vice presidents; E. J. Stackpole, Jr., Secretary.

OTHER PUBLICATIONS AND SERVICES

American Aviation Daily: Daily News service for the entire industry, $200 per year. Managing Editor—Keith Saunders.
American Aviation World-Wide Directory: Twice-yearly listing of products, people and organizations, $9.00 each (U.S.A. and Canada); $10.00 each Overseas. Managing Editor—Marion E. Grambow.
Official Airline Guide: Monthly publication of airline schedules, fares, World-Wide Edition: $19.50 per year, everywhere. North American Edition: $13.50 per year in U.S.A. $14.00 in Canada: $15.00 elsewhere. Published from 139 N. Clark St., Chicago 2, Ill. Phone: Central 6-5804. Managing Editor—Robert R. Parrish.
Missiles and Rockets: Magazine of World Astronautics. For those in missiles and rocket industry and satellite science. $8.00 for 1 year; $12.00 for 2 years (U.S.A. and Canada); Overseas—$9.00 for 1 year; $14.00 for 2 years.
Air Traffic News (Incorporating Air Traffic Digest): Daily rates and tariff news. $200 per year. Managing Editor—Mary Miller.
Airports: Weekly newsletter for airport officials suppliers and services. Airmailed every Friday, $25 per year. Managing Editor—Wallace I. Longstreth.
Air Information Division: 595 Broad Avenue, Ridgefield, N. J. Phone: Whitney 5-8850. Director—Edward H. Henkler.
Who's Who in World Aviation: First Edition Over 2,000 biographies of aviation's leaders. 345 pp. Deluxe bound, $10.00 per copy, postpaid.
Aircraft Year Book, Aviation Facts and Figures (Official Publications of Aircraft Industries Association).

Copyright 1957 by American Aviation Publications, Inc.

BPA NBP

Contents

FEBRUARY 11, 1957

VOL. 20 NO. 19

INDUSTRY ROUNDUP

Marine Corps Modernizes Its Airpower 29
Army Reveals Requirements For Aerial Jeep 31
IAS Report: Schriever Punctures Missile Misconceptions 35
North American X-10 Navaho Testbed 37
IAS Engineering Report: Nuclear Radiation Problems 38
Are We Losing Airpower Race to Reds? 40
Better Organization Key to Facilities Planning 43

FINANCIAL

Douglas Plans $25-Million Debenture Issue 44

ELECTRONICS

Minneapolis-Honeywell Tackles Inertial Component Challenge 53

ENGINEERING

Boundary Layer Control Has Proved Worth 61

BUSINESS FLYING

Copter Service Firms Expand Operations 81

TRANSPORT

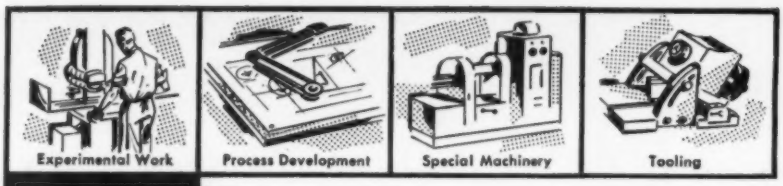
Political Pressures Make Life Difficult for CAB 93
WAL Tries New Approach: Takes Tickets to Customers 94
Super B Engine Boosts C-46 Utilization 95
Mohawk to Increase Capacity of Convair 240s 99
Decentralization of Authority To Feature TWA 'New Look' 102

DEPARTMENTS

Personal View 9
Letters 12
Books 12
When & Where 14
Washington Report 17
News Digest 20
Production Spotlight 24
Airtrends 26
New Products 63
West Coast Talk 78
International Aviation 85
People 86
Transport Trends 91
Sam Saint Says 100
Airline Commentary 103
Contracts & Facilities 107
En Route 108

PHOTO CREDITS

Department of Defense, pp. 29 and 30 (top); Hiller Helicopters, p. 30; AMERICAN AVIATION sketch, p. 31; Cessna Aircraft Co., p. 32; Lockheed Aircraft Corp., p. 36; North American Aviation, Inc., p. 37; Beech Aircraft Corp., p. 47; Southwest Airmotive Co., p. 51; U.S. Air Force, p. 52; Minneapolis-Honeywell, pp. 53, 56, 59 and 60; Petroleum Bell Helicopter Services (top) and Norris Jackson (bottom), p. 81; Champion Aircraft, p. 82; Western Air Lines, p. 94; Photographic Illustration Co., p. 95; United Air Lines, p. 103.



which of these WINSLOW services do you need?

Winslow Standard Guillotine Gage

Winslow Standard Multi-Jet Gage

Winslow Standard Length Gage

A CREATIVE ENGINEERING SERVICE FOR PRECISION METALWORKING

For any precision metalworking plant, Winslow offers a complete consulting engineering service that covers everything but actual design of the product and its actual manufacture. This service is based on years of working in close co-operation with *all* of the country's aircraft engine manufacturers and on Winslow's large investment in metalworking research.

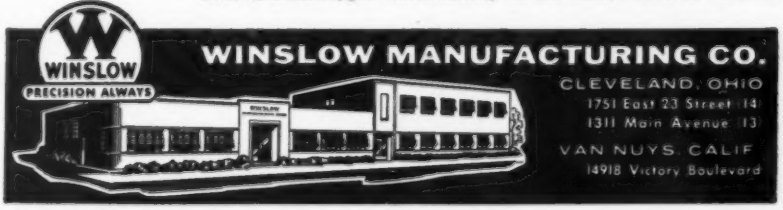
Starting with your part print, Winslow works out process problems, determining how the part can be efficiently manufactured. Equipment is specified and floor-planned. Special machinery needed is designed and built by Winslow, as well as special tools and gages. Efficiency and accuracy control procedures are set up.

Winslow's large staff of engineering designers and metalworking experts represents long experience with a great variety of different problems. Winslow has completely set up a number of plants for important manufacturers. All of Winslow's consulting service—or any part of it—is available to you.

WRITE FOR ENGINEERING BROCHURE

Winslow's "Engineering Brochure" describes in detail the Winslow consulting service, tells how Winslow works with customers. Included are actual case histories of typical Winslow jobs and the Winslow customer list.

Winslow's Guillotine, Multi-Jet and Length Gages are the standard of the jet engine industry for blade contour, thickness and length control. Like other Winslow gages, they feature Winslow's unique "interchangeable parts" design to cut costs, avoid obsolescence, give "More Accuracy for Less Money." Write for literature.



ACTUAL SIZE

LIGHTER, SMALLER ADF
WITH GREATER ACCURACY, HIGHER SENSITIVITY

NEW, COMPACT BENDIX DFA-70 HAS INCREASED EFFECTIVE RANGE, ELECTRICAL TUNING, FLUSH-MOUNTED ANTENNA

Bendix* ADF—long the "standard of the industry"—reaches another new high in performance and reliability with this new, improved DFA-70 system. Covering all frequencies from 90 to 1750 kilocycles, it provides both visual and aural navigation information, including narrow-band Consol reception. And with the greater accuracy and higher sensitivity that have been built into the system, a significant increase in operating range is obtained.

One of the important features of this new system is the electrical tuning which permits the Control Panel to be located as far as 50 feet from the receiver. In the design of the DFA-70 Control Panel, shown above, human engineering principles have been used to make tuning fast, easy and precise. Frequency knobs are labeled for quick identification; panel markings are large and easy to read; location of controls on the panel is planned for maximum accessibility.

Another important feature is the newly designed flush-mounted loop antenna. With this new unit, precipitation static is greatly reduced and drag is completely eliminated.

For complete information and specifications about the DFA-70, write Bendix Radio Division, Aviation Electronic Products, Baltimore 4, Maryland. Or West Coast—10500 Magnolia Boulevard, North Hollywood, California; Export—Bendix International Division, 205 East 42nd Street, New York 17, New York.

*REG. U.S. PAT. OFF.

½-ATR DFA-70 RECEIVER features sub-chassis construction, ARINC Class 1 ruggedized tubes, improved circuitry for minimum power consumption.

Bendix Radio Division

Bendix AVIATION CORPORATION

Circle No. 4 on Reader Service Card.

What's special about these pneumatic controls?

Janitrol aircraft pneumatic controls are special because each new control has a backlog of successful, service-proved designs behind it. *Many designs incorporate multiple functions in an integrated package*—actuation, pressure regulation, and air control. Invariably the "package" weighs less, takes up less room than separate controls. Choose from service proved designs or set your own requirements.

Three of many different types in service: 1. Canopy seal regulator actuates mechanically by canopy movement—maintains pressure in inflated seal, but releases instantly for emergency escape. Auxiliary port provided for other uses. 2. Pylon tank regulator with relief valve, maintains constant pressure for fuel transfer. 3. High pressure anti-icing valve, regulates jet engine bleed air pressure for use in anti-icing systems.

Janitrol's pneumatic controls are an outgrowth of long engineering and manufacturing experience in aviation air handling and heat transfer equipment.

Janitrol Aircraft-Automotive Division, Surface Combustion Corporation, Columbus 16, Ohio . . . District Engineering Offices: Washington, D. C., Philadelphia, Columbus, Ft. Worth, Hollywood.

COMBUSTION SYSTEMS · HEAT EXCHANGERS · PNEUMATIC CONTROLS

Janitrol®

This Pressure Transducer tames a Turbojet tornado!

Controlling the tornado of intake air consumed by supersonic jets is the latest assignment of Giannini's High Resolution Pressure Transducer. This versatile instrument plays a key role in maintaining optimum efficiency of today's newest and most advanced high performance turbojet engines.

Two of these transducers form the heart of the Giannini designed and produced Variable Inlet Control System which limits diffuser air to a steady subsonic flow at all speeds and altitudes. Static and total air pressures in the diffuser throat are sensed by absolute and differential versions of the transducer, and this data is transmitted to a computing element. The ratio of pressures is compared to a stable reference, and error signals are fed back to position a variable obstruction, or ramp, in the inlet duct.

By using these unique pressure instruments as sensing elements in the Giannini system, several distinct advantages result: the transducers can be located near the pressure probes, minimizing pneumatic tubing length; no stable amplifier is required since the high level output of the transducer potentiometer pickoffs can be used directly; no repeater servo is required; the system is flexible, control pressure ratio being altered merely by adjusting the reference; the computer can be located remote from the transducers.

The Giannini Variable Inlet Control System is typical of applications to which this instrument can be put. **Capabilities** of 350 volt output, 2000 wire resolution, 0.8% linearity, repeatability to 1% of *reading*, and its rugged insensibility to vibration and shock make it ideal for use in the most critical airborne controls and systems... In case you're not interested in taming a tornado – perhaps it's only a mild breeze – Giannini High Resolution Pressure Transducers are admirably suited for telemetering and control applications requiring the ultimate in accuracy and sensitivity.

Giannini Variable Inlet Control System

Write for Bulletin 451212.

Giannini PRECISION INSTRUMENTS & CONTROLS

G. M. GIANNINI & CO., INC. • 918 EAST GREEN STREET • PASADENA, CALIFORNIA

Personal View

By WAYNE W. PARRISH

Inevitable: A Single Traffic Control Agency

AS THE PRESIDENT'S special assistant for aviation facilities planning, Edward P. Curtis will be making his formal recommendations shortly for handling the nation's future air traffic control.

It would seem that he has no alternative but to recommend a single federal agency for the handling of both military and civil air traffic.

Anything less than a single agency will fall short of requirements. The recent series of collisions, tragedies and incidents bear stark witness to the need for positive control.

Air traffic control needs to be managed like a business. It *is* a business. It is and must be a federal business. There is no room for politics, no room for exceptions wherever traffic volume requires control.

We were pleased to note that Col. Samuel Mundell of ARDC at Wright-Patterson AFB has now advocated a merger of civil and military air traffic control activities into a joint agency. He spoke his piece at the recent Institute of the Aeronautical Sciences meetings in New York.

We agree heartily with Col. Mundell on the principle of merging. There is no alternative other than merging all air traffic control into a single agency.

The momentous question is *what* agency. We are sure that the able Mr. Curtis will make specific recommendations. For ourselves, we believe that air traffic control warrants and requires an independent agency, something on the order of the Atomic Energy Commission. It must have a civilian head. It must not be dominated by, although it must be fully representative of, the armed services.

A single agency must be responsible for all civilian and commercial traffic, all military traffic, all aircraft company test flying, and must be responsive to the needs of the Air Defense Command. There is no need for ADC to assume a dominant role until and if an emergency arises, at which time a switchover in emphasis can be immediate.

For much too long the military has considered itself something apart. For far too long the military has avoided a responsible attitude to the nation in regard to traffic control. Also, for far too long there has been stubborn (but futile) adherence to the principle of freedom of movement for everybody including putt-putts in heavy traffic areas.

The idea that there can be various kinds of traffic control for various kinds of air traffic is absurd. It would be the same as having a traffic light system in a city with only part of the vehicular traffic subject to the lights. CAA currently has definitely limited control over only part of the traffic.

We don't envy Mr. Curtis in his task of making recommendations. It is impossible to please everyone. But the skies are no longer unlimited. We've run out of air. The interests of all, from the millions of air passengers to the requirements of air defense, must be considered and melded into a single independent management control dominated by only the major interest of the country.

Fares Up?

United Air Lines took the industry lead the other day in asking CAB to approve a 6% 'cross-the-board fare increase. Capital Airlines followed immediately. It is no secret that most other carriers favor a fare hike and will follow suit.

Reasons: Gas costs have gone up sharply. United's gas bill will be up $2.1 million this year; American's will doubtless exceed that figure. Airport landing fees are going up. One large engine company jumped up its prices. Payroll costs are climbing. In terms of all other products and services, the airlines have held the price line to a rather astonishing degree. But the limit has come and the CAB, in the ultimate, has no choice but to approve fare increases generally.

Game for Insiders

Top USAF brass have quietly pleaded to outsiders not to engage in a "numbers game" controversy over wing strength. But maybe USAF should have a little inside conference to settle its own "numbers game." Both General Twining and AF Secretary Quarles appeared before the House armed services committee. Both appeared with charts showing the planned program for fiscal 1957. The charts were quite different. Both showed the same totals, but the breakdowns varied all over the place and USAF personnel were unable to make them jibe to mystified inquirers. Somebody had better take an inventory before any more wings disappear.

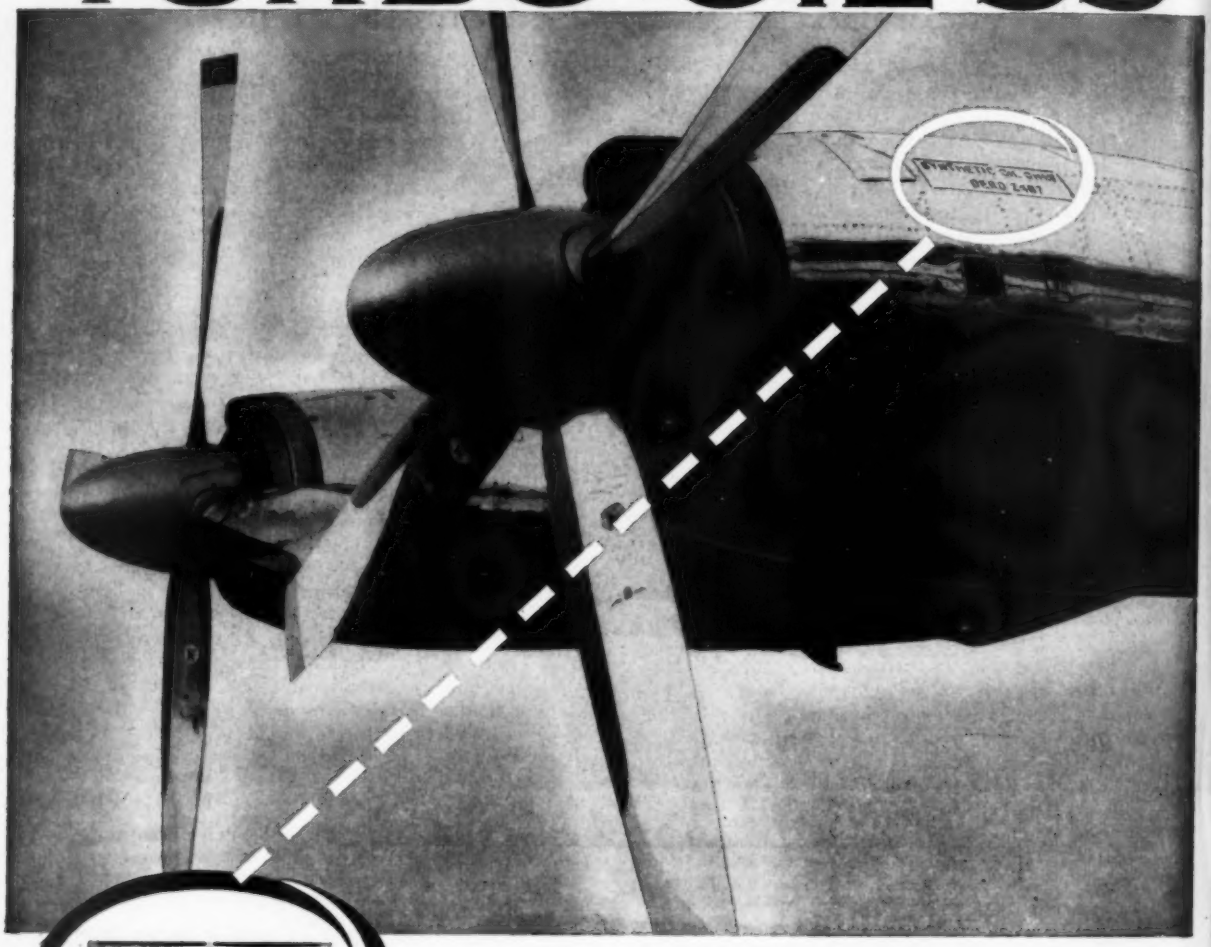
Cheers

The creator of that magnificent cartoon strip known as Steve Canyon, a fine gent by the name of Milton Caniff, has received the Air Force's highest civilian award. It was a grand token of gratitude by USAF for a strip which has been of real service to all airmen. The ceremonies were well done and Milt was deeply touched. Only in the U.S. can such things as this happen and we commend USAF for its thoughtfulness and congratulate Milt Caniff for his superb and engrossing daily pictorial. (Naturally we are a devoted Steve Canyon fan, as who isn't?).

Orchid to Cleveland

We had our first visit to Cleveland's handsome new airport terminal recently. An orchid to an impressive and presumably efficient building. We say presumably because our visit was brief and incomplete. Having set what must have been a world record for an overcrowded, inadequate facility, Cleveland has done itself proud with its new terminal.

ESSO AVIATION TURBO OIL 35



STILL THE ONLY OIL *APPROVED* FOR VICKERS VISCOUNT TURBO-PROPS

This imprint appears on the nacelles of Rolls-Royce "Dart" turbo-prop engines—the famous engines that power the Vickers Viscount. A synthetic lubricating oil is specified because no existing mineral oil—not even those of the highest quality—can meet the Rolls-Royce requirements. Several years ago, Esso Research, working closely with British and American aeronautical engineers, tackled the problem of developing a suitable lubricant for aircraft gas turbines. Result: Esso Aviation Turbo Oil 35—a synthetic oil with all the outstanding lubricating properties needed for Rolls-Royce and other leading aircraft turbine engines. And today, Esso Aviation Turbo Oil 35 is still the only approved lubricating oil for the Viscount's turbo-props.

The development of Esso Aviation Turbo Oil 35 is just one more example of Esso's continuing leadership in creating new and better fuels and lubricants for the new and better aircraft of today—and tomorrow.

8 OUT OF 10 OF THE WORLD'S INTERNATIONAL AIRLINES USE

ESSO

AVIATION PRODUCTS

Circle No. 7 on Reader Service Card. ⟶

use COOPER *shelf service*

AN 3 THRU AN 20
AN 21 THRU AN 36
AN 73 THRU AN 80
AN SIX DIGIT SERIES
AN 173 THRU AN 186
NAS 333 THRU NAS 340
NAS 428 SERIES
NAS 464 SERIES
NAS 501 SERIES
NAS 517 SERIES

for faster service on precision fasteners AN, NAS, MS*

ARE YOU ENJOYING the tremendous convenience of obtaining your precision fasteners when you need them *as you need them* through Cooper Shelf Service? Let the "Industry's Inventory" save you uncertainties, delays and production tie-ups.

*Cooper Service is faster on Specials, too. May we quote?

now thirty million

~~3~~ 20,000,000

standards in stock

Typical Inquiry

What you can expect from Cooper Shelf Service is illustrated by this typical customer inquiry which found all items available for immediat shipment—additional quantities available within two weeks.

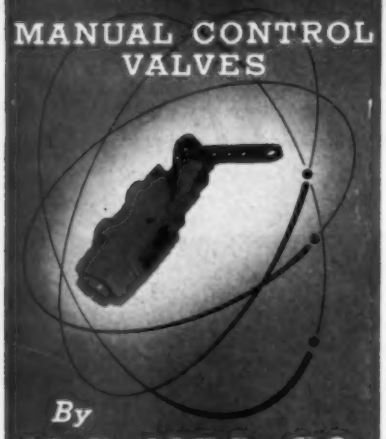
AN 3-5A	97000
AN 16-20A	265
AN 3C-4A	84000
AN 12C-43	325
AN 3DD-4A	34000
AN 8DD-35A	1300
AN 23-8A	45000
AN 30-50	450
AN 73-2	11500
AN 80-15	385
AN 73-A2	9700
AN 81-A47	210
AN 173-3A	6300
AN 182-41	570
AN 173C-5A	5200
AN 178C-47	420
AN 174DD-4A	1350
AN 177DDH-21	490
NAS 333-PA-3-45	64000
NAS 340-A25	275
NAS 428-3-6	14000
NAS 428-6-16	940
NAS 464-3A-5	15500
NAS 464-16-45	340
NAS 501-3-3A	39000
NAS 501-8-20A	975
NAS 517-3-0	38000

symbol of security in

COOPER PRECISION PRODUCTS

5625 West Century Boulevard, Los Angeles 45, California • ORegon 8-3973

MANUAL CONTROL VALVES



By
M.C. MFG. CO.

The one shown is:
MC 1888 VALVE—AIR CONTROL, THREE PORT
fulfilling the following aircraft specifications:

FLUID: Air or Nitrogen
PRESSURE RANGE: 0 to 3000 psi
TEMPERATURE RANGE: —65°F to +225°F
FLOW FACTOR: F=.07
PORT CONNECTIONS: Per AND 10050-4
INTERNAL LEAKAGE: 3 cc/hr. max. with 3000 psi at pressure port.
EXTERNAL LEAKAGE: Zero
WEIGHT: .5 lbs.
MILITARY SPECIFICATION: Applicable paragraphs of MIL-P-5518 and MIL-P-8564

Hydraulic and Pneumatic Components for the Aircraft Industry

VALVES OF ALL TYPES: Relief • Solenoid • Manual Control • Transfer • Shuttle • Brake • Control • Fluid • Pressure Reducing • Restrictor and Special

ALSO: Air Compressors • Fuel Pumps • Dehydrators

M.C. MANUFACTURING CO.
118 INDIANWOOD ROAD
LAKE ORION, MICHIGAN

West Coast Office: 716 Wilshire Blvd. Santa Monica, Calif.

Representatives:
D. & O. ENGINEERING CO.
P.O. Box 3107, Wichita, Kansas

L. YOUNGS
7520 12th., N.E., Seattle 15, Wash.

F. C. MINCH
1132 Denson Drive, Dayton 10, Ohio

Circle No. 29 on Reader Service Card.

Letters

Navigation Standards

To the Editor:

As a practicing specialist navigator and executive member of the International Airline Navigators Council, I have read with interest your commentary "The Ice is Thin" (AMERICAN AVIATION, Dec. 31, p. 7) and endorse your implied criticism of this particular example of low standard navigation.

As both CAA and the operator concerned seem reluctant to publish the full facts, the several inaccuracies in your comment are understandable.

I must, however, in fairness to my profession, point out that the two "navigators" (??) in question have been described by a CAA spokesman as pilot/navigator and pilot/student navigator, the latter presumably uncertificated. As indicated by these designations, their primary profession is pilot, and navigation is merely a compulsory—and often unwelcome—sideline forced on them en route to command.

You are probably aware that this particular airline is one of the few in the world that prefers this Jack-of-all-trades approach to that of pure specialization.

In view of this . . . your comment is most timely and I hope it will help bring to the attention of all concerned the fact that a review of both CAA and airline policy on long-range navigation is long overdue . . .

W. W. WILSON
IANC Vice-Chairman
Australasia

Wingala, N.S.W., Australia

Liked Weather Story

To the Editor:

Just a note to tell you of the very favorable reaction not only here at headquarters but among our field personnel to your interesting piece "UAL Centralizes Its Weather Service" (AMERICAN AVIATION Jan. 14, p. 98). I have heard many comments both within and outside United Air Lines as to the interesting manner in which the material is presented.

WILLIAM M. O'HERN
Director of Publicity
United Air Lines.

Chicago

Orchids for Saint

To the Editor:

Orchids to Sam Saint on the article "Blind Spot in Airline Planning" (AMERICAN AVIATION, Dec. 31, 1956, p. 32). His articles are always most timely, and as an airway traffic controller I appreciate the foresight found in them. In my opinion, AMERICAN AVIATION is a "must" on the reading list of every traffic controller.

With more analysis and induction of such ideas, the traffic problem can be solved.

GARLAND E. BELL

Jacksonville, Fla.

To the Editor:

You are to be congratulated for having acquired Sam Saint as a contributor to your magazine. He will add a tone of authority with respect to the traffic control problem. It is commendable that you seek to exceed the high standards that you have established by acquiring Sam's talents.

WILLIAM J. ARMSTRONG, JR.
1805 Brisbane St.
Silver Spring, Md.

Books

Instrument Flying. *By P. V. H. Weems and C. A. Zweng. 6th revised edition, published jointly by Weems System of Navigation, Annapolis, Md. and Pan American Navigation Service, No. Hollywood, Calif. 298 pp. Illustrated. Price, $6.00.*

A new and revised sixth edition of *Instrument Flying* updated for students and pilots qualifying for instrument flight ratings. Includes detailed sections on instruments, navigation aids, navigations, electronics, meteorology and air traffic control.

Cost-Quantity Relationships in the Airframe Industry. *By Harold Asher. Published by The Rand Corp. 199 pp. Illustrated.*

A current analysis of the validity of the use of so-called progress or learning curves in estimating the cost of aircraft, Rand Report R-291 is the result of an Air Force-sponsored study project. Address copy requests to Rand Corp., 1700 Main St., Santa Monica, Calif.

Introduction to Helicopter Aerodynamics. *By W. Z. Stepniewski. Revised edition, incorporating Typical Helicopter Performance Calculations, authored by R. J. Harris, L. H. Sloan and K. W Ulrich. Published by Rotocraft Publishing Committee, Box 55, Morton, Pa. 257 pp. Illustrated. Price, $4.50.*

A revised edition of Rotary Aircraft Series No. 3, this volume includes latest theories for predicting helicopter performance, including the results of most recent studies by the National Advisory Committee for Aeronautics and other research agencies.

Civil Air Regulations In Plain English For All Pilots. *By Sam R. Hamilton. Published by T. S. Denison & Co., 321 Fifth Ave. So., Minneapolis 15. 95 pp. Illustrated. Price, $3.00.*

A somewhat elementary approach to presentation of Civil Air Regulations, apparently intended for use as a student text. Hamilton is aeronautical ground instructor in the Aeronautical Engineering Dept., Univ. of Minnesota.

Sectional Properties of the Circular Fractions. *By Monroe Ames. Published by Exposition Press, 386 Fourth Ave., New York 16. 27 pp. Price, $5.00.*

A handbook of tables to simplify computations of aeronautical structural and mechanical engineers such as stress analysts in arriving at moments of inertia of areas bounded in part by circular arcs.

SAC Silver Jubilee Newsreel

by JACK PATTON

WHO'S THAT— THOMAS A. EDISON?
SAC'S SHOPS WERE AMONG FIRST TO BE SCIENTIFICALLY EQUIPPED.
FIX THIS. FIX THAT! NEXT!
EARLY-DAY MECHANICS WERE SKILLED JACKS-OF-ALL-TRADES.
30¢ AN HOUR! YIPES, WE'RE RICH!
GEO. KELLEY & W.J. CONNELL CAME FROM ARLINGTON STATE COLLEGE ... STILL WITH US.
YOU'RE FAMOUS TOO, SENOR, SOUSE OF ZEE BORDER!
AMONG FIRST BIG JOBS WERE FOUR PILGRIM MONOPLANES FROM MEXICAN AIRLINE.

A salute to three old friends: Hal Henning (cockpit), Maj. W. F. Long (standing), and The Texas Company! Henning flew this Texaco Waco when, in late '33, he joined Doc Booth as partner. Today, SAC—Booth-Henning's offspring—and Texaco still are close co-workers in business aviation. Bill Long is our good neighbor, and Hal Henning is the much-admired chief of GMC air transport ops, Detroit.

LOCKHEED VEGA

FAIRCHILD

STINSON

Booth-Henning began the SAC tradition of versatility in top-quality service for anything with wings, such as the early business planes seen above. For business flying, the military, and the airlines, quality and versatility remain synonomous with Southwest Airmotive. Here's a typical modern ramp scene.

1932 —A QUARTER CENTURY OF LEADERSHIP— 1957

Southwest Airmotive Co.
LOVE FIELD DALLAS
DIVISIONS: KANSAS CITY, KANSAS / DENVER, COLORADO

Circle No. 8 on Reader Service Card.

Airport Space and Facilities

BLYTHE AIR BASE
CALIFORNIA

Ideal for the manufacture, test, maintenance, modification, repair or storage of: aircraft, aircraft components, armament, guided missiles, drones, jet engines, rockets.

Five thousand acres isolated from populous regions. Four long runways, which can be readily expanded. Large parking aprons. Operational buildings & hangars.

BLYTHE AIRCRAFT CORPORATION
P. O. Box 191, Alhambra, California
CUmberland 3-2181
Circle No. 38 on Reader Service Card.

narco

More narco radios are in use in business aircraft for navigation and communication because narco offers reliable, dependable, high-performance equipment for every purpose.

See your narco dealer

narco
NATIONAL AERONAUTICAL CORP.
Fort Washington, Pa.

Circle No. 41 on Reader Service Card.

When & Where

FEBRUARY

Annual Jet Age Conference, sponsored by Air Force Assn., Sheraton-Park Hotel, Washington, D.C., Feb. 14-15.

Western Joint Computer Conference, sponsored by IRE, AIEE and ACM, Hotel Statler, Los Angeles, Feb. 26-28.

Management Research Symposium on Transportation, Purdue University, Lafayette, Ind., Feb. 27-28.

MARCH

Annual Air Safety Forum of Air Line Pilots Assn., Hotel Shoreland, Chicago, Mar. 5-7.

National Conference on Aviation Education, sponsored by National Aviation Education Council, Mayflower Hotel, Washington, D.C., March 7-8.

Nuclear Congress & International Atomic Exposition, Convention Hall, Philadelphia, Mar. 11-15.

IAS Flight Propulsion Meeting (classified), Hotel Carter, Cleveland, Mar. 14-15.

Gas Turbine Power Conference, sponsored by ASME, Sheraton-Cadillac Hotel, Detroit, Mar. 18-21.

American Society of Tool Engineers, Silver Anniversary meeting, Shamrock-Hilton Hotel, Houston, Tex., Mar. 25-27.

Western Metal Exposition and Congress, sponsored by American Society for Metals and other technical groups, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Mar. 25-29.

APRIL

SAE Aeronautic Meeting and Production Forum, Hotel Commodore, New York City, Apr. 2-5.

IRE Professional Group on Telemetry and Remote Control, national symposium, Philadelphia, Apr. 15-17.

Arnold Air Society annual conclave honoring 50 years of military air power, Hotel New Yorker, New York City, April 17-20.

Airport Operators Council, Conrad Hilton Hotel, Chicago, Apr. 28-May 2.

MAY

American Assn. of Airport Executives annual convention, Shamrock-Hilton Hotel, Houston, Tex., May 5-8.

Aero Medical Assn. 28th annual meeting, Shirley Savoy Hotel, Denver, May 6-8.

American Helicopter Society, annual forum, Sheraton-Park Hotel, Washington, D. C., May 8-11.

Armed Forces Communications and Electronics Assn., convention, Sheraton-Park Hotel, Washington, May 20-22.

Design Engineering Conference of American Society of Mechanical Engineers, Coliseum, New York City, May 20-23.

Aviation Writers Assn., annual convention, Chase and Park-Plaza Hotels, St. Louis, May 26-June 2.

JUNE

First Annual Trade Show, National Aviation Trades Assn., Monmouth County Airport, N. J., June 1-9.

American Society of Mechanical Engineers, semi-annual meeting, Sheraton-Palace Hotel, San Francisco, June 9-13.

SOUTHERN CALIFORNIA
Aviation
HEADQUARTERS

★ AVIATION ROOM
Home of the "Q.B's"
★ AIRLINES CENTER
American, Pan-American, TWA, and Western ticket offices.
★ AIRPORTRANSIT
Exclusive Hollywood Stop
★ AIRCRAFT MFG. CENTER

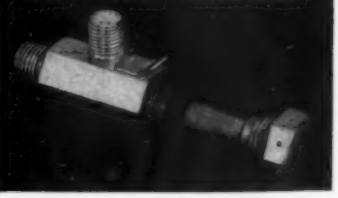
Cinegrill ★ Garden Grill
Heated Swimming Pool
under management
Hull Hotels

Hollywood ★ ★ ★
ROOSEVELT
★ ★ ★ Hotel

7000 HOLLYWOOD BLVD. HOLLYWOOD 28 CALIF.
• PHONE HO 9-2442 • TELETYPE LA 547
THOS. E. HULL, DIRECTOR
L. B. NELSON, GENERAL MANAGER
Circle No. 39 on Reader Service Card.

PIONEER MANUFACTURER OF AVIATION OXYGEN BREATHING EQUIPMENT

WHY TAKE CHANCES?



GET GREATER PROTECTION FOR YOUR AIRBORNE OXYGEN BREATHING EQUIPMENT WITH A PURITAN HIGH PRESSURE FILTER UNIT

Protect regulators and other sensitive parts of your aircraft oxygen system against costly damage due to pressure surge. Puritan's High Pressure Filter Unit gives you these important advantages:

- Precision metal-to-metal seal avoids leaks.
- No special tools needed to install or replace filter.
- Sintered bronze filter, pore size .0017.
- Easy to install on upstream side of regulator or manifold.
- Rugged construction—corrosion resistant—light weight.

Quality materials plus fine craftsmanship — that's Puritan.
When ordering, specify No. 118001 High Pressure Filter Unit.
Price $4.50 each F.O.B. Kansas City.

Aviation Division
Puritan SINCE 1913
PURITAN MAID

COMPRESSED GAS CORPORATION
2010 GRAND AVE. KANSAS CITY 8, MO.
Circle No. 40 on Reader Service Card.

for Navy's new A3D Skywarrior...

Flight Control System—by Sperry

Fast, long-range jet attack bombers like the new 600/700-mph Douglas Skywarrior require super-precise flight control systems to match their flashing speed and power. And the need for precision control becomes even more critical when they're designed, like the A3D, to carry many types of the Navy's carrier-based weapons.

This need is fully met by Sperry's advanced S-5 Automatic Flight Control System, specified for all of the A3Ds. Biggest and most powerful aircraft ever built for carrier operations, the Skywarrior multiplies the scope of our Navy's combat range potential. In so doing, it imposes extra demands on its navigation and control system. For example, Sperry engineered a special feature into the S-5 system which permits the rudder channel of the automatic pilot to be used as a yaw damper.

Beyond such special requirements Sperry's S-5 system meets all standards of accuracy and reliability required during bombing runs and the long hours of flight back to its tiny landing field afloat.

R. P. SNODGRASS, Director-Flight Research of our Aeronautical Equipment Division. Serving aviation as engineer, analyst and test pilot, he directs Sperry's fleet of aircraft, evaluating new equipment and low-weather flying techniques.

The S-5 Flight Control System is only one of many Sperry systems designed especially for the job to be done. Other Sperry systems are in use today on many of the world's leading airlines, on hundreds of business planes and on thousands of military aircraft.

Write our Aeronautical Equipment Division to find successful solutions to your flight control problems. You'll find Sperry engineers well qualified to help you.

SPERRY GYROSCOPE COMPANY
Great Neck, New York
DIVISION OF SPERRY RAND CORPORATION
BROOKLYN • CLEVELAND • NEW ORLEANS • LOS ANGELES • SEATTLE • SAN FRANCISCO. IN CANADA: SPERRY GYROSCOPE COMPANY OF CANADA, LTD., MONTREAL, QUEBEC

Circle No. 9 on Reader Service Card.

THE **SOUND** OF PROGRESS

What is the sound of Progress? It's the whine of a jet... the busy hum of a computer... the deep roar of a rocket engine... the swish of helicopter blades. But the most important "sound" of all is mute... that of creative minds at work, solving tomorrow's problems today.

These sounds... accomplishments of engineering research... represent many "firsts" at Bell Aircraft. Here the sound of genius is reflected in such advanced projects as the GAM-63 Rascal, a long range strategic air-to-surface guided missile... the bold quest of the X-2, the world's fastest and highest flying airplane... the jet-powered X-14 VTOL... the XV-3 convertiplane... the XH-40 turbine-powered helicopter... rocket engines... electronics... servomechanisms... and atomic research.

Bell's engineers are daily meeting and resolving tomorrow's complex problems in all fields of science. *These are the sounds of progress.*

BELL Aircraft CORP.
BUFFALO N.Y.

RESEARCH, DEVELOPMENT AND PRODUCTION IN THE FIELDS OF: Guided Missiles • Research Aircraft Servomechanisms • Electronics • Rocket Engines • Electronic Control Systems • Vertical Rising Aircraft

Washington Report

How to Strangle Criticism

Proficiency of the military services in smothering efforts by outside groups to change their (military) ways of doing business is well known. It has inspired the wrath of congressional committees, the despair of study groups and commissions.

At the moment, Air Force is giving deputy Defense Secretary Reuben Robertson, Jr., a first-hand demonstration of its mastery of this art.

Last summer, a special aircraft study group appointed by Robertson completed a detailed study of the problem of shortening aircraft development and production lead-times. The group proposed more centralized military control of individual weapons development projects, less supervision of contractors, more timely and better-informed decisions on development projects and a variety of other changes aimed at getting better weapons in less time.

An *ad hoc* committee headed by Robertson found the proposals sensible and directed the services to carry them out.

Then the fun began. Although largely devoid of security implications, the recommendations nevertheless were classified at Air Force insistence.

Freed of prospect of informed public criticism, USAF slowed execution of the recommendations to a crawl, although Navy is said to have accepted them.

Robertson reportedly has reached the boiling point. Like his predecessor, Roger Kyes, he may knock some heads together to get action. But the same end might be accomplished if he could break loose the report and recommendations to the press so that informed criticism by the parties concerned can make itself felt in the formulation of public policy.

Collision Revives Airspace Debate

Military vs. civilian use of the airspace is stirring congressional ire. The mid-air collision over California involving a DC-7B on a pre-delivery test flight and a military jet has revived the debate.

California Republican Sen. Thomas Kuchel is disturbed by the Civil Aeronautics Administration directive encouraging regional officials to set up voluntary test flight areas in sparsely-settled areas.

Key word is "voluntary." Kuchel objects to the cooperative nature of the directive, thinks rules should be more stringent. Consequently, he is preparing legislation with teeth in it calling for Civil Aeronautics Board to enforce separation rules.

Senate Commerce Committee chairman Warren Magnuson (D-Wash.) agrees CAB should be prodded. Although the Board has authority to establish the airways, Magnuson says it has neglected the task beyond the commercial phase. He has ordered an investigation to determine if the military has the right to block out huge areas of airspace.

Airpower Probers Set Sights

A four-pronged investigation of U.S. airpower readiness will be launched by a special Senate Armed Services Committee task force headed by Sen. Stuart Symington.

Probers will look into aircraft procurement, maintenance, operations, training and training facilities. Assisting Symington will be Senate Majority Leader Lyndon Johnson (D.-Tex.) and Sen. Styles Bridges (R-N.H.).

Task force is not a carryover of the Symington Airpower Subcommittee, but it will explore some of the same territory, including U.S.'s alert status and plans to improve our air might.

A starting date of "soon" was stamped on the investigation, with aircraft manufacturers and military leaders slated to be called for questioning.

Meanwhile, House Armed Services Chairman Carl Vinson (D.-Ga.) disclosed plans to order a study of roles and missions assigned various services in Secretary Wilson's controversial order of last November. No date is set for this one.

More Firms Tackling Atoms

The list of aviation companies active in the atomic energy field is growing steadily. In its latest semi-annual report, the Atomic Energy Commission disclosed that eight companies in the airframe, engine and equipment sections of the industry are tackling important nuclear reactor projects.

The appearance of four of the companies is readily understood. Pratt & Whitney Div. of United Aircraft Corp. and General Electric Co. are slated to provide nuclear reactors for the Air Force's atomic aircraft, while Lockheed Aircraft Corp. and Convair Div. of General Dynamics Corp. will design and build the airframe. All four of these companies are using reactors in one way or another to carry out their assignments.

But four other aviation companies are exploiting atomic energy in research and power-producing applications in fields not directly related to aviation. These are North American Aviation, Inc., The Martin Co., Bendix Aviation Corp. and Aerojet-General Corp. All four are building or plan to build reactors of various types for non-aviation customers.

Behind the Times

Some congressmen and news services are getting mixed up on the complex U.S. aviation situation. Here are two examples that followed the California mid-air collision:

Sen. Arthur V. Watkins (R-Utah) issued a news release urging "Charles J. Lowen, Administrator of the Civil Aeronautics Administration" to take steps to install long-range radar at Salt Lake City. Lowen died last September and since has been succeeded by James T. Pyle, whom Watkins, in the release, calls Lowens' deputy.

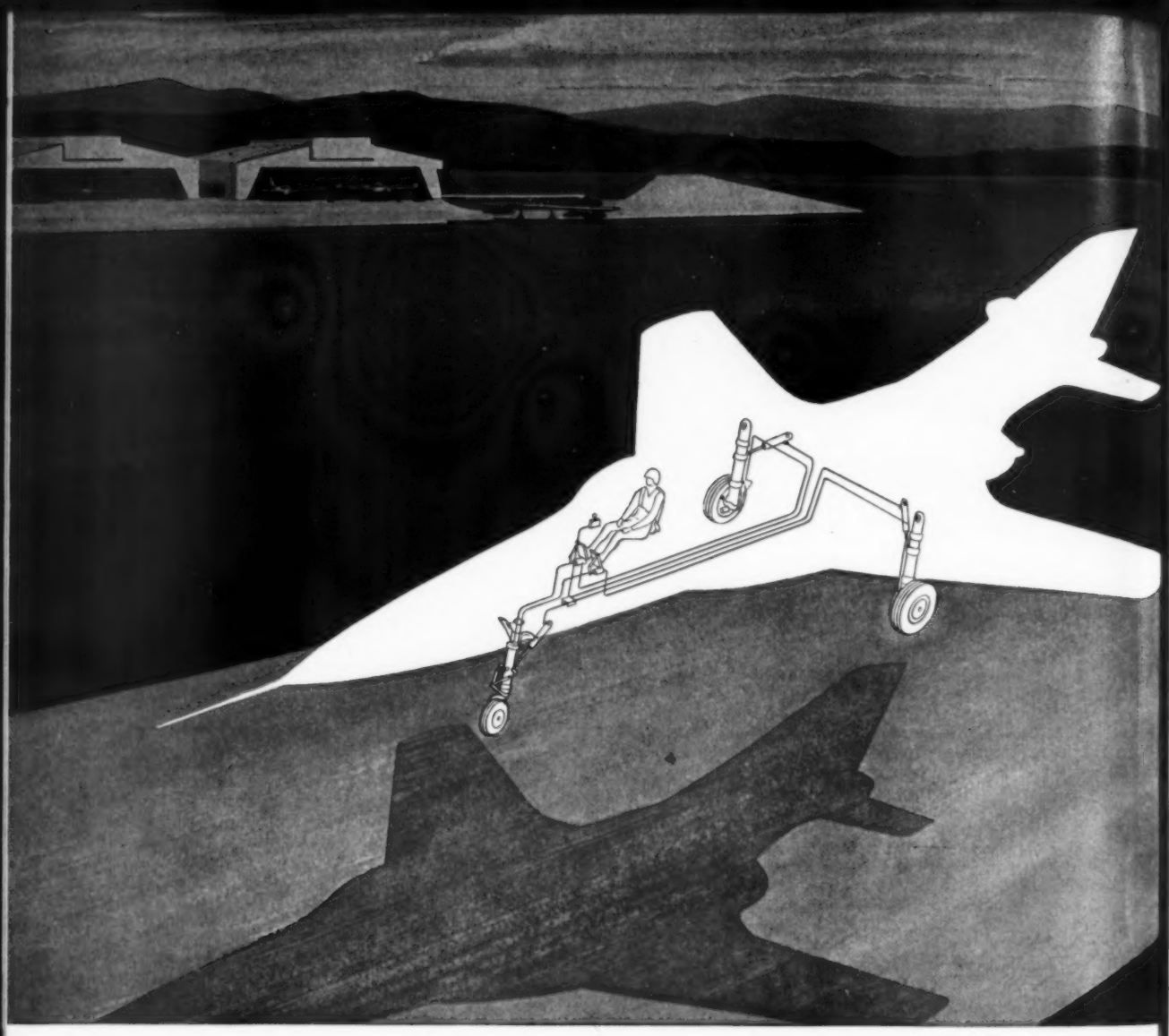
Same day, Rep. Oren Harris' House Commerce Committee announced it would start hearings within a few days into the Pacoima, Calif., mid-air collision. One wire service reported that CAB Chairman Ross Rizley would be one of the first called to testify. Rizley left CAB chairmanship 10 months ago, is now a federal judge.

India Seeks Jet Funds in U.S.

Indian government's negotiations for U.S. financing of Air-India International's three Boeing 707 jet transports apparently are being conducted unilaterally.

International Bank for Reconstruction and Development (World Bank) will put up part of the money, with a group of East Coast banks supplying the remainder. There is no liaison between World Bank and our State Department.

Amount involved, including cost of spares: $24 million. Similar financing was arranged by Australian government for Qantas' 707s.



FROM TOUCHDOWN TO TAKE-OFF

WITH A COMPLETE BENDIX SYSTEM FOR LANDING GEAR

During ground contact, between touchdown and take-off, the safety of the plane and crew depends upon the unfailing teamwork of everything that makes up the landing gear system.

Retractor actuation, control valves, nose wheel steering, power braking, as well as wheels, brakes and shock-absorbing struts—even tires—these are the things that make up the complete landing gear system. And it is vital that all components function together with split-second accuracy and efficiency.

That is why Bendix specializes in complete and integrated landing gear systems. For, components that have been designed and engineered to work together give better and more dependable performance than any arbitrarily assembled system. The components of a Bendix landing gear system are engineered as a matched set, then tested and tuned to work together like a trained crew.

And there is a further important advantage in having one source completely responsible for production and over-all operation on the airplane.

So, when it comes to gear for landing, think and plan in terms of a complete landing gear system. Then we suggest you think of Bendix and Bendix Products Division at South Bend, Ind.

Bendix PRODUCTS DIVISION **South Bend,** IND.

Bendix
AVIATION CORPORATION

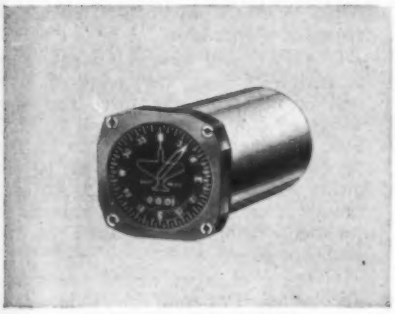
Circle No. 10 on Reader Service Card.

FICo

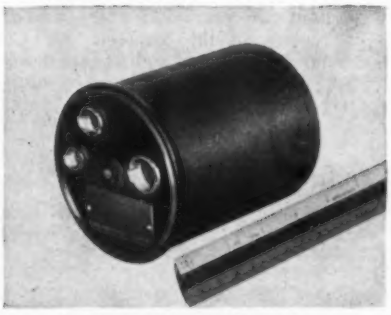
Aeronautical Systems, Subsystems and Related Equipment

The latest in navigational systems, radar techniques, instrumentation, data processing equipment—and many other types of projects are Ford Instrument Company's contributions to the field of aeronautics. FICo engineers are in the process of carrying out research studies, developing advanced systems, and overseeing the quantity production of some of the most superb equipment available anywhere.

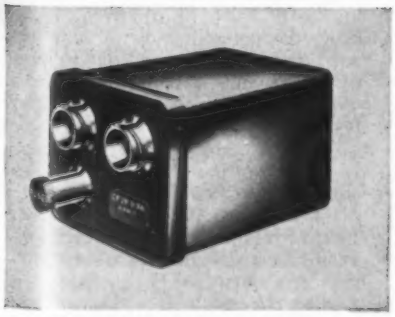
TYPICAL FICo AERO PRODUCTS



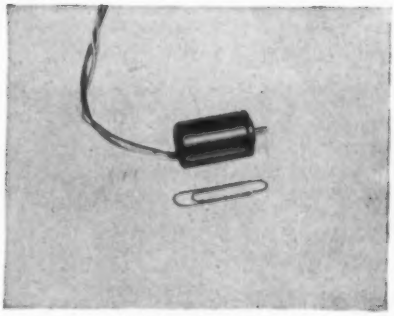
Indicator Unit of ASN-7
a dead-reckoning computer that displays course and distance.



Analog-to-Digital Converter
for airborne sensing application.



Magnetic Variation Computer
automatically compensates for variations in earth's field.



5/8" Servo Motor
a high precision subminiature unit highly applicable to aero equipment.

FICo
AERONAUTICAL ABILITIES ARE INDICATED BY THIS PARTIAL LIST:

- **Navigational Computers**
  Systems that provide present position, and course and distance to destination.
- **Airborne Sensing Systems**
  For air traffic control.
- **Computing Timers**
  For aerial photography.
- **Cruise Control Computers**
  To help pilots handle fast flying aircraft with maximum efficiency.
- **Radar Data Processing**
  For a wide range of applications.
- **Turret Drives**
  Magnetic amplifier types, precluding problems of hydraulics.
- **Computer and Control Components**
  Telesyn synchros and resolvers, servo motors, integrators, differentials, rate generators, and other units.
- **Complete Guidance and Control Systems**
  For any missile type.
- **Plotting Equipment**
  For ground and airborne applications.
- **Analog-to-Digital Converters**
  For airborne applications.
- **Exhaust Temperature Indicators**
  For jet aircraft.

AND A WIDE VARIETY OF RELATED PRODUCTS

Write to:

FORD INSTRUMENT COMPANY
DIVISION OF SPERRY RAND CORPORATION
31-10 Thomson Ave., Long Island City 1, N. Y.

Dayton Office
Ford Instrument Company
29 West 4th St.
Dayton, Ohio
Phone: Michigan 2373

California Office
Ford Instrument Company
260 South Beverly Drive
Beverly Hills, Calif.
Phone: BRadshaw 2-6675

Circle No. 20 on Reader Service Card.

Industry News Digest

Quarles, Twining Defend Budget, Wing Cutback Won't Weaken USAF

In his first appearance before the Democratic 85th Congress, Air Force Secretary Donald Quarles staunchly defended his department's new 128-wing force structure and its $17.7-billion request for new money in fiscal 1958.

Quarles told the House Armed Services Committee the new budget will permit the Air Force to maintain its deterrent strength and improve its effectiveness. He conceded under questioning that the budget ceiling would delay modernization of the USAF, but declared:

"I can state without reservation that our present retaliatory deterrent force is much more powerful than it was a year ago."

• **Gen. Nathan Twining,** USAF Chief of Staff, agreed with this view. Because of the superior performance of new equipment and the increased power of new weapons, he said, the Air Force planned to cut its old 137-wing program "without regard to budgetary pressures."

"I would naturally feel more confident if the resources available to the Air Force permitted more rapid modernization of aircraft and supporting equipment and a faster rate of improvement of our base and support system," Twining admitted. "However, I recognize that there is an element of risk in any military program."

• **Considerable confusion** occurred when Secretary Quarles and Gen. Twining sought to explain the impact of the wing cutback on the USAF force structure. This resulted from their use of different versions of the Air Force's 137-wing program as the basis for their presentations. Air Force spokesmen later tried to clear it up with charts, but these produced still other discrepancies which the spokesmen refused to explain. Here is the picture that emerged:

The Air Force originally planned to have 137 active wings by June 30, 1957. According to the plan as it was written two years ago, there would be 51 wings in the Strategic Air Command, including six fighter-escort wings. Air Defense Command would have 34 wings and the Tactical Air Command would have 52 wings, including 11 airlift wings, 17 fighter-bomber wings, 13 wings of day-fighters and *no* Matador wings.

In July, 1956, this plan was rewritten. The 137-wing total remained the same, but the composition of the force was changed substantially. One unactivated wing of fighter-escorts was lopped from SAC, leaving it with a planned strength of 50 wings by June 30, 1957. Two unactivated wings were cut from ADC, giving it a mid-1957 goal of 32 wings.

• **A net increase** of three wings was ordered in the mid-1957 TAC goal, giving it a total of 55 wings. Its day-fighter strength was reduced three wings, to 10, while its fighter-bomber strength was increased one wing to 18. One wing of Matador missiles was added to the structure—the first USAF missile wing. And four wings of C-123 assault transports were added to the force, making the airlift total 15 wings.

The new force plan to be achieved by the end of fiscal 1958 cuts nine wings from this mid-1957 force so that the Air Force will have 128 wings. These will consist of 45 SAC wings, representing the elimination of five remaining fighter-escort wings, and 32 wings of ADC interceptors, unchanged from the earlier level.

• **TAC will have** 51 wings, a net reduction of four. One wing of B-45s will be cut from the force and three wings of fighter-bombers will be dropped, bringing the latter total to 15. Day fighter wings will remain at 10 and airlift wings will stand at 15. An additional wing of Matador missiles is planned, bringing the total to two such wings.

These changes would result in a net reduction of only three wings from the Fiscal 1957 plan for TAC; but Air Force planners intimate that still another wing—for some reason not mentioned by either Quarles or Twining—will be lopped from TAC to bring the net reduction to four wings. Air Force spokesmen refused to identify the wing, but it could be either another tactical bomber wing or a photo-reconnaissance wing.

The cutback in SAC escort wings is based on the fact that only three wings of slow B-36 bombers will remain in the SAC inventory by mid-1958, while there will be eight wings of B-52s which do not need escort.

The ADC reduction was made possible by the introduction of the more potent Century series of aircraft and new missiles, USAF officials said, while the TAC cut is based on the superior performance of the new equipment plus growing Army ability to provide its own close support with missiles.

• **The official rationalization** of the force cuts failed to impress the Air Force Association. In an editorial in the February *Air Force* magazine, it accused the Administration of playing a "numbers game" with the Air Force wing structure and declared the USAF "no longer has a force goal."

Army Orders Lacrosse Missile Production

Martin-Baltimore has received an Army production contract for XSSMA-12 Lacrosse surface-to-surface all-weather artillery missile shown on munitions carrier. Lacrosse was developed by Cornell Aeronautical Laboratory and is powered by a solid rocket motor.

AF Plans Slowdown in Production Of Most Aircraft in Century Series

Deceleration of Century series aircraft is planned by Air Force, AF Secretary Donald Quarles revealed last week, confirming earlier reports of major cutbacks and eliminations in programming which already are under way. The reshuffling will affect all aircraft in the series, except Convair's F-102A and F-106.

Prime reason is the coming missile age, coupled with the advent of the B-52 bombers. Fighter-escorts are no longer needed in Strategic Air Command as the B-52s replace the B-36s. Increased Army firepower has lessened dependence on Tactical Air Command close-in support. And, finally, integration of two TAC Matador missile wings is replacing TAC manned-aircraft wings. Fiscal 1958 budget restrictions have an indirect effect on the total program.

• **Actually the realignment** of the Air Force, reflected in the new budget, has caught the service with a surplus of Century series aircraft. Secretary Quarles also revealed that, with the exception of the two Convair interceptors, the aircraft have presented "more engineering problems than anticipated," and it has been decided "not to accelerate to the degree originally contemplated in order to incorporate engineering fixes on a greater number of production airplanes."

Hardest hit so far is McDonnell Aircraft Corp's F-101 models. The F-101A, scheduled for SAC fighter-escort wings, is wiped out. Completed aircraft will be converted to the reconnaissance version (RF-101A) for TAC. The F-101B program for ADC has been reduced, with production buildup retarded. An improved engine version also is scheduled for a majority of the production planes. While the programming cutback is not expected to have an immediate effect on McDonnell's $480 million in F-101 orders, there will be no further follow-on contracts, Air Force spokesmen said.

• **Overall, Pentagon paints** the picture this way:

TAC already has more aircraft than it needs. It is operating a substantial number of F-84Fs and the F-86 series, as well as F-100A day fighters and F-100C fighter-bombers with the F-100D now in production.

Scheduled to be completely equipped with Century planes by the end of fiscal 1958, TAC is trying to make room for the Republic F-105. The surplus dims the possibility of North American F-107 going into quantity production. In overall planning, the day-fighter version of the F-104 appears to be ruled out.

TAC will probably go to the RF-101A in the reconnaissance category. Only one wing is scheduled at this time. This will rule out the reconnaissance version of the Lockheed F-104.

Air Defense Command already has F-102A interceptors in service and will receive the F-104 and F-106. The latter has been accelerated to make up for the cutback in the F-101B.

UAW Wants Aircraft Apprentice Program

Legislation to establish an apprenticeship program in the aircraft industry will be sought by the United Auto Workers, according to Leonard Woodcock, vice president-director. He said the union would campaign for rules compelling all government contracts to include a special clause providing for an adequte company training program.

UAW, which just completed its seventh national aircraft conference in Washington, will also seek the following goals in upcoming negotiations:

- An industrywide union shop and some form of supplemental employe benefits.
- Higher wages, based on the 1956 percentage formula.
- Opposition to inclusion of "beginners' rate schedules" in contracts, on grounds they are often designed to "chisel" on legitimate rate payment.
- Elimination of intra-plant inequities, and assurance of equal pay for equal work on a corporation-wide and eventually and industry-wide basis.
- Improvement in insurance programs in current contracts, to achieve maximum company-paid comprehensive coverage for the worker and his family.
- Continuing efforts to obtain corporation-wide bargaining in multi-plant organizations where UAW has contracts.
- Joint bargaining in plants where workers are covered by both UAW and IAM.
- Woodcock also said the minimum hourly wage in the aircraft industry covered by government contracts should be increased substantially from the current $1.05.

Air Force Unveils Bell Rascal Missile

Rascal, for which Bell has just received new contracts totaling $22 million, is shown here on ground-handling cradle. Photo shows evidence of extensive retouching to disguise actual nose shape and radome for sonar equipment on air-to-surface missile.

Bell Aircraft Corp.'s GAM-63 supersonic Rascal missile shown after air-launching from Boeing B-47. Rascal measures about 30 ft. long, weighs about 13,000 lbs. and is powered by Bell-developed liquid rocket engine.

United, Capital Ask 6% Fare Rise; Cite Increased Cost of Operations

Two airlines—United and Capital—will ask CAB for fare increases to help offset continually rising costs.

Although there was no indication at presstime whether others would follow, American Airlines and Eastern Air Lines issued statements pointing out the need for an increase

First action was taken by United Air Lines, which said it will ask a 6% across-the-board boost, to be effective April 1. Tariff will be filed March 1, and will apply to first-class, coach and excursion rates for domestic and Hawaiian operations.

Terming United's action "most constructive," Capital Airlines said it will file for a 6% increase plus a hike of $1 per ticket as a "terminal factor."

• **The announcements** came in the face of CAB's pending general passenger fare investigation which, among other things, is exploring the possibility of an industry fare reduction. The tariff filings will focus attention on the need for an increase.

United president W. A. Patterson said that while various other forms of transport have increased as much as 83% during the past 20 years "it is a great tribute to the efficiency of the airline industry that we have continued to absorb rising costs with practically no increase in rates. In fact . . . air coach service has substantially lowered . . . fares."

The company, he added, has been absorbing its own rising payroll costs, increased costs of its vendors, and boosts in costs of materials and services. "For example, within the past 30 days increases in the price of gasoline will cost United an added $2,100,000 in 1957. We have no assurance that this is the end of increased gasoline prices.

"Increasing efficiency in airline operation will continue to act as an offset to rising costs. However, this factor has reached the limit of its ability to do the whole job without the help of a modest increase in the price of our product."

Commenting on the proposed increases, C. R. Smith, president of American, although not saying whether AA would or would not file, pointed out that "the costs of today cannot be met with the fare level of 15 years ago. We are hopeful that an increase in fares will be permitted as promptly as possible."

• **Thomas F. Armstrong,** president of Eastern, said an increase of at least 10% "is both justified and necessary. This could be accomplished with no burden on the traveling public and without affecting controls on inflation by the elimination of the 10% excise tax on transportation which Congress authorized as a war emergency measure and which tax is still in effect today."

Auditors' Report on PAA Books Touches Off New CAB Controversy

A confidential report by Civil Aerounatics Board auditors, reflecting the first comprehensive audit of Pan American World Airways' four divisions, has embroiled the agency in a new controversy.

At presstime, various members of Congress were pressing for public disclosure of the auditors' findings, and CAB, undecided as to the report, was pressing an investigation to find how the existence of the report "leaked" out.

The report was passed secretly to Board members on December 27, 1956. It was signed by Warner H. Hord, chief, office of carrier accounts and statistics. It included conclusions of the auditors with respect to PAA bookkeeping practices which CAB, in a delicately-worded release, said have neither been accepted nor rejected.

• **Among other things,** the auditors challenged entries relating to transactions between PAA and one or more of its 30-odd subsidiaries and affiliates. Report covers the year 1954 for which no permanent mail rate has been set for PAA by the Board.

Leading to the extensive PAA audit was pressure from various Senators, Congressmen, and the General Accounting Office who, for the past few years, have been critical of CAB's auditing set-up.

In announcing its investigation of the apparent "leak," CAB referred to the audit this way: "The periodic audit of Pan American's books and records was recently completed by the Board's audit staff in the normal course of its duties."

The statement, however, was viewed as a compromise between the Board's audit staff, which prepared the report on Pan American, and the mail rate staff, which fixes subsidies and has challenged the report.

Audit Chief Hord told reporters immediately after the CAB release that the PAA audit was "the most extensive check ever made by the agency."

• **CAB has** given no indication that there is a connection but early last month the agency moved to recapture $5.9 million in subsidies paid PAA for transpacific operations in 1954.

At that time, the agency said the outstanding temporary rate for 1954 "appears excessive." It also sought recapture on the same day of $1.4 million in subsidies paid Northwest Airlines for 1954 Pacific operations.

Pan American officials were strong in their opposition to publicity given what they referred to as "an incomplete audit report." Pan Am president Juan T. Trippe and other officials visited with CAB Members several hours before the Board announced its investigation of the "leak." Subsequently, a Pan Am wire to CAB was released which confirmed the airline had asked CAB to conduct such an investigation.

Both CAB and Pan American emphasized that the airline had not had a chance to rebut any of the auditors' findings. Whether the opportunity for such rebuttal, if deemed necessary, would be in a public or private forum was not disclosed.

UAL Cuts Cash Dividend To Push Expansion

United Air Lines has reduced its quarterly cash dividend on common stock from 37½¢ to 12½¢ a share and has declared a 4% stock dividend. The move is designed to aid the financing of expansion plans.

Estimated record 1956 net earnings of $14,680,500, including $4,399,400 from sale of surplus aircraft, were announced by United. The 1955 net was $11,244,577, including $80,548 from plane sales.

President W. A. Patterson said the prudence of the dividend action "is influenced by expansion plans for the next several years, combined with the necessity of keeping financially strong during the transition to the jet age and the current tightness of the money market." The quarterly cash dividend is payable March 15 to stock of record February 15, while the 4% stock dividend is payable June 15 to stock of record May 15.

New Process Improves Magnesium Extrusions

A 40% increase in strentgh of magnesium alloy extrusions is claimed by the Air Research and Development Command for shapes formed through a Dow Chemical Co. process.

The process uses 0.016-inch magnesium pellets alloyed with zinc and zirconium for added strength. Pellets, formed by hurling molten metal from a fast-spinning disc, are cooled as they fall through a natural gas atmosphere, are then heated to 600°F and blown directly into an extrusion press.

Representative strength figures given are: compressive yield of 11-inch I-beam increased from 30,000 to 42,000 psi; compressive yield of 4-inch I-beam increased from 30,000 to 40,000 psi.

CAB Experts Probe Two Major Accidents

Civil Aeronautics Board safety specialists have launched investigations into two major accidents—the January 31 collision of a Northrop F-89 and Douglas DC-7B over Pacoima, Calif., and the February 1 crash of a Northeast Airlines' DC-6A shortly after takeoff from LaGuardia Field, N. Y.

The F-89/DC-7B collision, involving a new transport due to be delivered to Continental Air Lines the next day (See photo, p. 93), also touched off demands for banning of test flights over populated areas.

CAA, as an interim measure, issued orders the following day to all its regions to meet with appropriate civil and military agencies and set up "voluntary" areas for all such testing as well as procedures for using them.

In addition, both the House and Senate Commerce Committees indicated they would institute hearings into the cause of the collision.

The Northeast accident, involving 20 fatalities, was the first experienced by the carrier involving a passenger fatality since it commenced operations in August 1933.

The aircraft, a DC-6A on lease from the Flying Tiger Line, was its sole equipment in New York-Miami nonstop tourist service and forced the carrier to suspend that operation indefinitely.

Northeast is operating the first of its new DC-6Bs in first-class service to Miami, will receive the second of 10 aircraft on order this month.

Trans American's Fate Up to Supreme Court

Continued operating rights for Trans American Airlines were guaranteed until March 11, 1957 by a stipulation filed with the U.S. Supreme Court. Entering the stipulation with the non-scheduled airline group were the Civil Aeronautics Board and the Department of Justice.

CAB has ordered the group out of business for "knowing and willful" violations of the Civil Aeronautics Act and CAB's economic regulations. The decision was upheld by the U.S. Court of Appeals in December.

But Trans American intends to appeal to the Supreme Court by March 11, and has been given continued license until that date. Its initial filing will be for a writ of certiorari in which the High Court will decide whether or not it will review previous rulings of the Appeals Court and CAB.

If the Supreme Court refuses to review, the CAB revocation action against Trans American will take effect in 45 days.

If the Court decides to review, the airline will stay in business at least until completion of such review.

Hughes' New Lightweight Helicopter

Hughes Tool Co.'s aircraft division has produced a new ultra-lightweight two-man helicopter for both military and commercial use. Vehicle is 19 ft. 5 in. long, 8½ ft. high, empty weight 850 lbs. Copter is shown during press review at Culver City, Calif.

News Briefs

MANUFACTURING—MILITARY

• **Temco Aircraft Corp.** will move its corporate offices from Grand Prairie to Garland, Tex., this summer on completion of a 100,000-sq.-ft. office building at the Garland plant site.

• **Cornell Aeronautical Laboratory** is developing a facility under a $2-million USAF contract that will permit testing of aircraft and missile designs in airflows up to 10,000 mph. and temperatures of 9,000°F.

• **McDonnell Aircraft Corp.** earned $3,862,453 after taxes in the first half of the fiscal year ended Dec. 31, compared with $2,663,902 net in the same period a year ago. Six months' sales were $125,545,573 against $85,562,656. Backlog on Dec. 31 was $831,171,849.

• **Cessna Aircraft Co.** and its National Aero Finance Co. subsidiary have developed a new "trial basis" plan for the Cessna Model 310 twin-engine business aircraft. It provides 30, 60 or 90-day leases for firms to try the plane without first making a large capital investment. If the customer decides to buy, a large portion of the rental is credited to the purchase price.

• **USAF has received** its first Boeing KC-135 jet tanker for testing. First operational tanker is expected to be in USAF's inventory in about six months.

• **Beech Aircraft Corp.** was winner of the 1956 Greer Maintenance Award for its service clinic program which provides free periodic inspections for all Beech aircraft by touring technicians.

• **Lockheed Aircraft Corp.** received $175-million in orders for piston and turboprop transports in 1956. Volume was exceeded only by the $314 million in orders received in 1955. Commercial backlog at the end of 1956 totaled $450 million, of which 55% is for the Electra turboprop.

• **Kay Labs,** San Diego, adopted the new trade name of "Kintel," which is a contraction of the three words Kay, instruments and television.

TRANSPORT

• **Delta Air Lines** reported 1956 net earnings from operations of $2,915,871, against $2,710,790 net in 1955. Total earnings last year, including profits on sale of flight equipment, were $4,224,641 against $2,969,640 in 1955. Operating revenues increased 16% to $72,343,884 while operating expenses rose 18% to $65,442,215. Revenue passenger-miles were up 18% to 1,188,996,000.

• **Mohawk Airlines** has received CAB approval to operate Syracuse-New York nonstop service for three years. Similar application of Eastern Air Lines was denied.

• **North Central Airlines** was authorized by CAB to operate between Grand Forks, N.D., and Omaha, Neb., via Fargo, N.D.; Watertown, Brookings, Sioux Falls, Yankton, S.D.; Sioux City, Iowa, and Norfolk, Neb. Award is good until 60 days after final decision in the Seven States Area Case.

• **Capital Airlines** sold two L-49 Constellations to California Eastern Aviation and has leased them back. Purchase price for the two planes was said to be about $2 million.

• **Sir Ivan Holyman,** chairman and managing director of Australian National Airways, died of a heart attack while vacationing in Honolulu. Sir Ivan founded Holyman Airways in 1932. It later became ANA, Australia's major domestic carrier.

• **The Babb Co.** bought four DC-3s from United Air Lines. One has been sold to Bonanza Air Lines and the remainder will be sold abroad.

B. S. E. E. Wisc. '43 — M. S. E. E. Purdue '49

Wanted:

Design and Development Engineers

ENGINEERS—like Jack Lower pictured on the facing page—find Honeywell an inspiring company to work for, because Honeywell's accelerated development programs offer challenge and opportunity.

With many design teams, working on a great variety of projects, we have exceptionally exciting careers ahead for engineers capable of designing components and systems for—

- INERTIAL GUIDANCE
- FLIGHT CONTROL SYSTEMS
- LIQUID MEASUREMENT SYSTEMS
- VERTICAL, RATE, AND INTEGRATING GYROS
- DIGITAL COMPUTERS

At Honeywell you'll head up your own task group. Draftsmen, technicians, model makers and evaluation engineers essential to the project will look to you for technical instructions.

An engineering degree or its equivalent plus practical experience with related or similar equipment is required.

Consider these advantages

- Minneapolis, the city of lakes and parks, offers you metropolitan living in a suburban atmosphere. No commuting.
- Travel and moving expenses paid.
- First rate salaries, insurance-pension systems, plant and technical facilities.
- Honeywell, leader in control systems, is a sound diversified growth company, continually expanding, that offers permanent opportunity to you.

Write to us

If you are interested in a career at Honeywell, call or send your résumé to Bruce D. Wood, Technical Director, Dept. TA-25A, 1433 Stinson Boulevard, N.E., Minneapolis 13, Minn.

MINNEAPOLIS **Honeywell**

AERONAUTICAL DIVISION

Production Spotlight

• First commercial Boeing 707 jet transport is scheduled to be sandwiched between the 21st and 22nd KC-135 Air Force tanker on the assembly line at Renton, Wash.

• Air Force's original WS-107 intercontinental ballistic missile guidance system reportedly calling for a radio-inertial setup has been cancelled in favor of a less precise system. Original concept was to provide radiometric correction of flight path to trajectory zenith after which the missile would follow a ballistic path. This now is deemed unnecessary.

• Least publicized name in Navy Regulus missile program is Stavid Engineering Co. of Plainfield, N. J., which developed ground guidance control system for Bureau of Ships. A conflicting guidance project, sponsored by BuAer with Bendix Radio Div., reportedly never actually guided a Regulus flight and has been dropped. Of three Regulus guidance systems developed by Stavid, last is understood to be compatible for both Regulus I and II guidance requirements.

• Air Force will convert about 980 F86Ds to F-86L configuration for Air Defense Command. North American Aviation has contract for major portion of work, with remainder to be done at Sacramento Air Materiel Depot.

• Despite pinch on USAF R&D funds, the Republic XF-103 project is still very much alive. Aircraft is to be powered by Curtiss-Wright turbo-ramjet combination engine.

• Tactical Air Command may get the Convair B-58 now that the Martin TBX advanced tactical bomber project has been canceled. B-58 would fill TAC's requirement for supersonic bomber.

• Beech Aircraft has delivered the first L-23D command transport to Army under a $2.8-million contract. L-23D is Army version of newest E50 Twin-Bonanza, has top speed of 240 mph, cruise 228 mph. Army has used L-23s more than four years.

• Cessna expects production of T-37 twin-jet trainers to reach a rate of 17 per month by mid-summer. Current contract exceeds $48.5 million, with large follow-on volume expected later.

• MATS apparently is happy with mating the Pratt & Whitney T34 turboprop engine to the Curtiss-Wright Turbolectric propeller. After completing lengthy operational tests with two Boeing YC-97Js using the combination, MATS reports the program completed six weeks ahead of schedule "without an untoward incident." The T34-Turbolectric combination is scheduled for the Douglas C-133A, which will be delivered to MATS later this year.

• Marine Corps' new Sikorsky HUS two-ton payload helicopter has made its first flight. HUS is development of Sikorsky S-58 commercial 12-passenger transport copter and is powered by Lycoming-built Wright R1820 engine. Marines will use the helicopter as troop and cargo carrier.

• Orenda Engines is about ready to start ground taxi tests with the B-47 it is using as a testbed for the Iriquois 20,000-lbs.-thrust jet. Engine is mounted on fuselage near tail. The Iriquois is slated to power Avro's CF-105 all-weather fighter. B-47 testbed will fly this spring.

• Sud-Est Aviation is stepping up production of Alouette turbine-powered helicopter to 15 a month. About 40 of 200 ordered by French, Portuguese, Swedish and Venezuelan customers have been delivered.

• Argentina's Instituto Aerotecnico will build 48 Morane-Saulnier MS 760 jet trainer/liaison aircraft with components supplied by the French company. Argentina has option to increase its production to 100 aircraft and sell to other Latin American nations. First components will be shipped from France next fall.

• Manpower will be a major factor in implementing intercontinental bombardment missiles. One ICBM wing is expected to require more manpower than the 3,000 now needed for a heavy bomber wing.

• Best Pentagon estimates are that a chemical bomber will be operational in five years, a nuclear-powered bomber a decade from now. Boeing and North American should come up with recommendations on the WS-110A exotic fuel aircraft within six months.

B.S.E.E. U. of Wisconsin, 1943; M.S.E.E. Purdue, 1949

This is Jack Lower, Chief of Gyro Design at Honeywell Aero, and one of the country's outstanding authorities on floated gyros. He and his associates translated an entirely new MIT concept into the world's first mass-produced floated gyro. Jack Lower, the people who work with him, and hundreds of other Honeywell engineers are the backbone of Honeywell Aero leadership in aircraft, missile and rocket control systems.

HONEYWELL AERO, MINNEAPOLIS 13, MINN.

DUTIES OF Air Research and Development Command's Western Development Division in connection with ballistic weapons have been extended into the operational area (see page 35). This sets a precedent. The job has normally been left to the command using the weapons.

WDD will train people, design and build first installations, work out supply tables and spell out operating procedures. In the past, ARDC's responsibilities in connection with manned aircraft have been limited to research and development of hardware.

As more radical weapons are introduced, USAF's operational commands will become more dependent on ARDC. The latter, through its research functions, is the only command with enough knowledge and experience to get the weapons into operation. This could be a strong force in getting research and development budget request up closer to where USAF planners really want it.

•

PERSONNEL RECRUITMENT COSTS charged off to the government by firms holding Navy contracts will get closer scrutiny. Following investigation, Navy concluded some companies are spending too much tax money to hire engineers and technical people.

Navy has promised to "exercise a greater degree of control over, and limit amounts" chargeable to the government. Investigation was prompted by a House subcommittee, headed by Rep. James C. Davis (D.-Ga.), which examined personnel procurement costs last year.

Using Navy data, the subcommittee calculated that one unnamed company spent $907,560 to acquire a net gain of 59 employes—or a net cost per worker of $15,328. Findings alarmed Rep. Davis. He's asked Defense Dept. to set up cost standards.

•

SPECIAL PENTAGON TEAM has uncovered chaotic conditions in procurement by NATO countries of spare parts for aircraft and equipment supplied by U.S. Team's two-month tour revealed that these countries lack adequate organizations for spares procurement, their individual orders are quite small, and frequently they require parts which are out of production in U.S. One possible remedy: creation of a single NATO procurement authority to handle all such purchasing.

•

MORE MISSILE SUPPORT FOR BRITAIN seems almost to result from British Defense Minister Duncan Sandys' recent talks with high-ranking officials in Washington. Sandys reportedly stressed his country's need to chop defense outlays to a more bearable level. He proposed ways this could be achieved, including big cuts in Britain's contribution to NATO forces and increased U.S. aid in antiaircraft and air-to-air missiles.

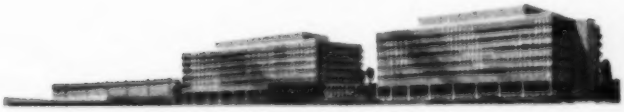
He was apparently urged to hold Britain's NATO force intact. At the same time, it appears likely he was promised more missile aid. This could take the form of off-shore procurement contracts to British aircraft companies to manufacture Talos, Nike B, Sidewinder or Falcon missiles under license from their U.S. producers.

as *Aero*-nautics is to earth

In the fields of both *AERO*-NAUTICS and *ASTRO*-NAUTICS Convair is showing outstanding leadership. **CONVAIR-*Astronautics*** is today building in San Diego, California, a complete facility for research, development and manufacturing of the Atlas Intercontinental Ballistic Missile, a top priority project of the U.S. Air Force. The Atlas is the first of many vital astronautical projects which will lead mankind toward a better understanding of the universe in which he lives.

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

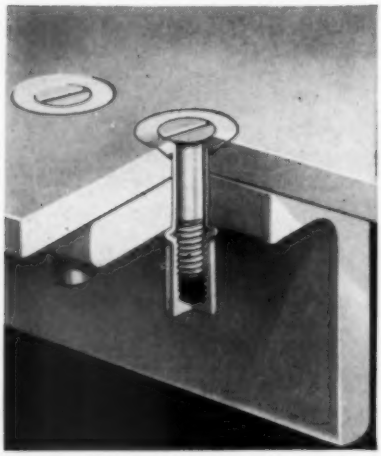


B.F.Goodrich

BREAKS ICE FASTER – Chordwise tubes, electronic controls and quick-snap inflation cycles make B. F. Goodrich pneumatic De-Icers an efficient, dependable system of ice protection.

LANDS BIG ONES–BFG wheel and brake assemblies give maximum strength, low weight, safe stops. New BFG high capacity disc brake already specified for propjet transports.

PROPELLER PROTECTION – Electrical De-Icers for propellers fit skin-tight on blades, cuffs and spinner, give added protection against eroding effects of rain, sand and dust.



GIVES FIGHTERS A LONGER REACH–Seal-Head Rivnuts fasten aluminum wing sections to form integral wing tanks in fighter plane, give it a longer range without weight sacrifice.

HEATED GIRDLE – BFG electrically heated rubber is light, flexible. Photo above shows how it provides heat for oil valve to maintain flow of oil despite low temperatures.

TAKES OFF WEIGHT–BFG Tubeless Tires help save weight, make possible bigger payloads. Dimpled tread wears slower, more evenly, gives more landings before recapping.

B. F. Goodrich Aviation Products improve performance, cut over-all weight, reduce maintenance

FROM THE VERY BEGINNING of the aviation industry, B. F. Goodrich engineers have designed equipment with an eye to dependable performance, lower weight and less maintenance.

Long experience in solving specific problems is reflected by a few of the products recently developed by B. F. Goodrich Aviation Products; a new disc-type brake that stops faster and smoother, has automatic two-way adjustment and longer service life; an omnienvironmental full pressure suit to protect pilots at high altitudes; and new chordwise De-Icers with smaller inflation tubes that parallel the direction of air flow.

Whether you are designing a new plane, converting existing planes or maintaining a fleet, B. F. Goodrich Aviation Products engineers can help you. Write for specific product information: B. F. Goodrich Aviation Products, Akron, Ohio.

B.F.Goodrich Aviation Products

A division of The B. F. Goodrich Company, Akron, Ohio

ESTABLISHED JUNE 1, 1937

World's Largest Aviation Publishers
American Aviation

VOL. 20 No. 19

Marine Corps Modernizes Its Airpower

Supersonic fighters with missile capability go into service this year, replacing older types such as F9F, FJ-4, F2H and F3D.

By LOIS C. PHILMUS

WHILE AIR FORCE, Navy and Army are constantly subjected to airpower re-evaluation, redefinitions, cutbacks and re-emphasis, Marine Corps air strength stands unique in its orderly consistency.

Its combat aircraft capability apparently has been stabilized at the three-wing level, with no change contemplated in fiscal 1958. Each wing averages about 350 fighter and attack aircraft, representing about 1,050 of the 1,425 aircraft inventory.

With their strength established, the Marines are now concentrating on a major modernization program in which supersonic fighters with missile capability will be introduced this year. Chance Vought F8Us will fly "sometime this year," Lt. Gen. Christian F. Schilt, Marine aviation commandant, revealed to AMERICAN AVIATION.

• **The supersonic fighter,** coupled with Douglas F4D Skyrays and "other" new Navy aircraft, is slowly replacing older types presently in the Marine fighter squadrons, including the Grumman F9F, North American FJ-4, McDonnell F2H-4 and Douglas F3D. Actually, some F4Ds already are in service.

The Douglas A4D Skywarrior has been selected as the Marine's new attack plane. It is "gradually" replacing the AD Skyraider which has been in service for sometime.

Missiles to Make Debut

Accompanying the new combat planes into service is air-to-air missile capability, particularly in the fighter field. Sidewinders and Sparrows also will make their bow this year. But Gen. Schilt said that while primary emphasis will shift to guided missiles, machineguns and rockets will still be used for some fighter missions. Ordnance for attack aircraft will be more varied.

Although highly classified, Marine aviation—specifically related to attack aircraft—is widely known to have nuclear capability.

• **The present** modernization program is definitely viewed as interim and does not preclude the Marines' "urgent" requirement for VTOL-STOL combat equipment. In acquiring the F8U and other supersonic fighters to come, the Marines are sacrificing their short takeoff and landing requirement for speed.

Intensive experimentation with catapults and arresting gear to shorten runway requirements in land operations is under way. The Marines are after effective lightweight, portable equipment. The equipment must be transportable by helicopter but still strong enough to reduce landing strips to less than 1,000 feet. While not yet available, General Schilt is sure it will be available "within about five years."

While the veteran Marine officer said he has "no doubt that vertical risers will be operationally ready in 10 years," other experts are a bit pessimistic. One Navy spokesman believes that the STOL-VTOL concept is "a lot farther away than most people want to think," pointing to the fact that to date there has been "no major breakthrough" in any development—particularly in the VTOL field.

But while awaiting results of such development, General Schilt said, "We will have to make present-day aircraft meet the situation that exists in the

Chance Vought F8U will carry missiles.

Douglas F4D Skyrays will operate from carriers.

Sikorsky HR2S-1, Marines' medium assault transport.

amphibious assault." Various catapult and arresting gear projects are under way backed by Navy's "considerable background" in shipboard operation.

"Since Marine aircraft are designed and equipped for carrier operations, the Marine Corps is in the position to achieve a true expeditionary air capability within the immediate future," he asserted.

Copters and Assault Planes

Two other phases of Marine aviation are getting attention, with re-equipment moving along smoothly—helicopters and fixed-wing assault transports.

In the latter category, the Marines are actively looking for a replacement for the present Fairchild R4Q and Douglas R5D. General Schilt envisions a turboprop transport that can serve double duty: Air drop of combat troops and assault materiel, and an added capability, such as an in-flight refueling tanker.

Specifications are out, it was revealed, and it was admitted that the Marines have "something in mind" for an existing aircraft. A Navy spokesman later filled in that the Marines "are looking" at Air Force operation of the Lockheed C-130. Apparently some informal discussions have been held on possible modification for refueling operations.

The Marine Corps recently took first delivery on the Sikorsky HR2S for a medium assault transport. It will be used primarily for landing assault materiel on shore and secondarily for carrying combat troops. General Schilt hinted that a possible turboprop version of the new helicopter may be the next phase in the category. It is the general's "personal opinion" that the HR2S is as large as helicopters should be for Marine carrier operations.

The Marine "helicopter family" program presently calls for five members. In addition to the medium HR2S transport, its status is as follows:

- One-man helicopter for liaison, reconnaissance and rescue operations is under development by Gyrodyne, Goodyear, Hiller and Rotorcraft and is in various stages of progress. The Hiller model recently made its first flight.
- Light assault transport for bringing troops ashore has been filled by the Sikorsky HRS, but this is now being replaced by the HUS-1.
- A cargo unloader, commonly called the "flying crane," is being developed by the McDonnell Aircraft Co. under a Navy BuAer contract. It was recently learned that it is designated the XHCH and is powered by the Allison T56 turboprop engine.

Next: Turbine Power

Next step in the Marine helicopter program is to go to turbine power. Navy BuAer spokesman estimated that operational models will not be ready until 1960 or, more probably, 1961. Biggest bottleneck has been a specifically designed turbine powerplant for helicopters. But it has been learned that General Electric is "moderately well" through development of the Navy T58 and is ready for "some sort of production scale."

The HSS T-58 testbed program is in full swing. However, further work and evaluation of the engine is necessary. But now the turbine helicopter delay may rest with airframe. All BuAer would say is that it does have "some programs," which "are not necessarily" adaptations of existing helicopters.

Concurrent with Marine helicopter plans and development, Navy Bureau of Ships is developing assault helicopter carriers. They are being designed to carry a number of transport helicopters, along with troops and equipment.

The modified CVE-55 class carrier, modified for helicopters, is with the Pacific Fleet where it is being used to develop and refine techniques for the new development program.

Summing up, General Schilt, who retires on April 1, generally felt that it would be "ideal" if the Marines could operate just one of each type of aircraft equipment. But he is resigned to the fact that "we will always have more than one" although most efficient Marine operations call for "as few as we can get." "The competitive spirit must be generated," he added. ◆◆◆

Boeing Drops Plans For Missile Division

Plans to establish a separate, fully-integrated guided missile division in California have been abandoned by Boeing Airplane Co.

Boeing had hoped to set up the division to manufacture the Bomarc surface-to-air interceptor missile for USAF and to carry out research and development on more advanced missile systems. USAF, however, refused to support the company's desires for the new division.

Options on a plant and some land in California will be allowed to lapse and Boeing will probably continue to build the Bomarc in Seattle with support from its Wichita division and a network of subcontractors.

Boeing came within two aircraft of meeting its master schedule for B-52 deliveries last year, according to president William M. Allen. When setbacks caused a lag in deliveries, Boeing established a "schedule recovery" program in mid-1956 aimed at catching up to within nine planes of schedule by year-end. This program was exceeded by seven planes.

Marines' New XROE-1 One-Man Copter

Hiller Helicopters has developed this one-man helicopter for the Marines. It weighs less than 250 lbs. and is powered by a two-cycle Nelson four-cylinder aircooled engine manufactured by Barmotive Products, Inc. Copter is disassembled by removing snap-out pins.

Army Reveals Requirements for Aerial Jeep

It's expected to carry recoilless rifle and/or rockets, plus platform for electronics control station; 'minimum silhouette' is sought.

By HENRY T. SIMMONS

The Army's aim of exploiting aerial mobility to the maximum extent possible is amply borne out in its current design competition for flying testbeds leading to the development of an "aerial jeep."

AMERICAN AVIATION has obtained the design and performance requirements specified by the Army for an aerial jeep in its invitation to prospective bidders to submit proposals for flying testbeds. Although the testbeds need not meet these requirements, they should be suitable for testing the feasibility of the flying jeep concept.

For operational use, the soldiers want a two-man flying machine capable of serving as an "aerial transporter and ground flying platform for recoilless rifle and/or suitable rockets" as well as an "aerial platform for an electronics control station." When it is not in use for these purposes, it should be capable of serving as a versatile utility transport like the standard Army ground jeep.

"Overall configuration should have a minimum silhouette and consideration should be given to arrangements wherein the lift system is beneath the platform," the specification stated. It called for provisions for at least one crew member in addition to the pilot when weapons are transported and said consideration should also be given to use of the machine for transporting passengers provided this does not impair its primary combat capabilities.

The Army spelled out the following general technical characteristics of the flying jeep:

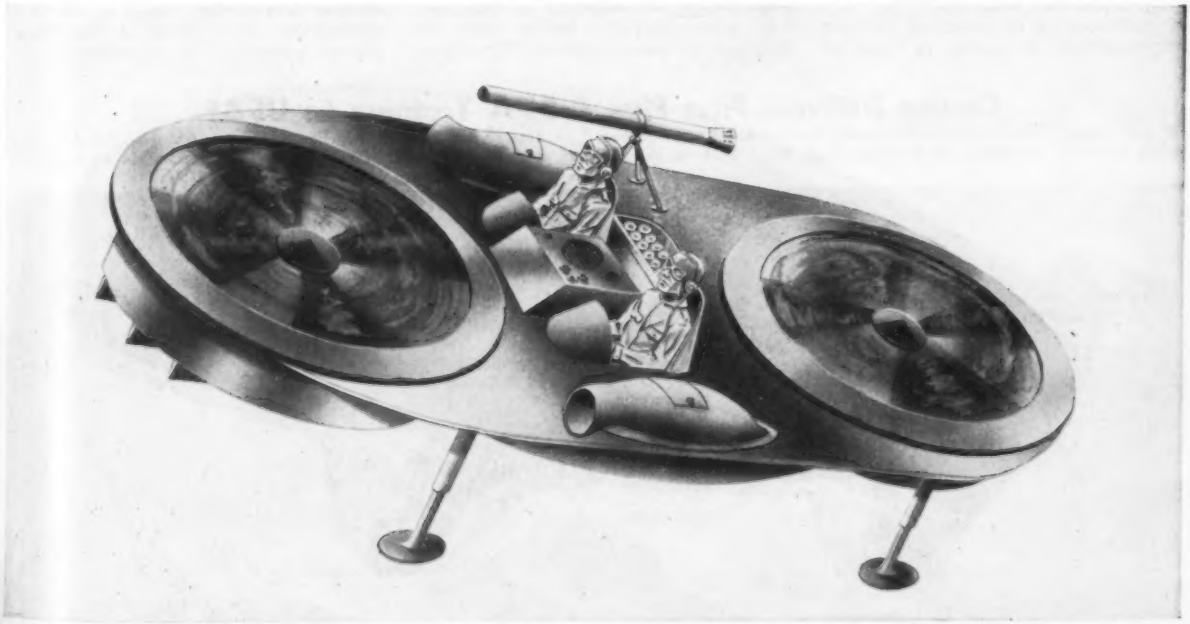
- Payload (including pilot): 1,000 pounds minimum.
- Range with design useful load: Minimum of 25 nautical miles.
- Normal cruise speed: Not less than 25 knots.
- Endurance:
  - (a) Normal mission: Minimum of 30 minutes.
  - (b) Hover mission: Minimum of 10 minutes.
- Hovering, takeoff and landing: Should be capable of hovering out of ground effect, takeoff and landing with design useful load at 6,000 feet altitude and 95°F temperature.
- Radio communication equipment: Two-way radio will be required (weight should not exceed 50 pounds).
- Fuel: Operation on standard Army fuels or JP-4 is required.
- Operational characteristics: Simple operation and ease of maintenance with a minimum of special tools and operating equipment are of prime importance.
- Shipment: Design should facilitate the movement of a minimum of four vehicles by air transportation in the C-130 airplane. Consideration should be given to transportation by helicopter of adequate size (external loading is applicable). . . . When shipped or moved by supporting modes of transportation the vehicle should be of such design that it could be readied for operation in a minimum of time.

The Army emphasized that the configuration and performance specifications it has suggested "are of necessity tentative ones since the concept of the vehicle and its design have not been fully explored." Proposals therefore may be submitted which deviate from the Army requirements for an operational aerial jeep if the contractor is convinced that a departure lies in the best interest of the government.

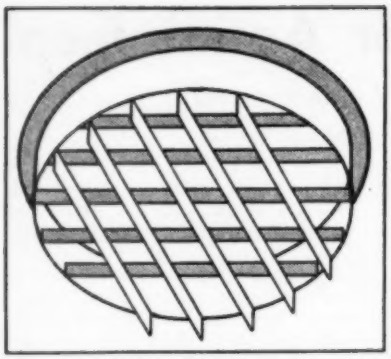
- **Competitive proposals** will be judged "primarily on the basis of suitability to exploration of the concept of operation rather than detailed compliance with the desired characteristics" set forth for an operational combat vehicle. Deadline for submission of proposals is Feb. 18.

Considerable additional information concerning the Army's ideas on design and employment of the aerial jeep is contained in a set of informal notes which accompanied the formal specifications sent to prospective bidders. For example, the Army explained that the operational aerial jeep "will generally fly just above the ground to take maximum advantage of the concealment afforded by environment." For this reason, it said, a minimum silhouette is desired.

The operational machine should have crew and cargo space equivalent



Artist's conception of a two-man aerial jeep utilizing ducted-fan system similar to that employed by Hiller flying platform. Two interconnected gas turbines provide power. Recoilless rifle is fired from ground position only; side position is suggested to avoid back-blast damage to the vehicle.



Vane systems beneath each duct provide directional control. Fore and aft vanes operate in opposite directions for turns; lateral vanes for forward and backward movement.

to that of the ground jeep, and a large center of gravity range is desired to permit rapid loading and movement of a variety of cargo. It should be capable of going into action within a minimum time—"considerably less than one hour and zero time if possible"—after being off-loaded from the C-130 transport, and a self-starting system is desirable, the Army said.

• **Configuration** should permit use of a 106-mm recoilless rifle or other weapon with an elevation range of minus seven degrees to plus 45 degrees, and a traverse of 60 degrees. Designers should take into account the fact that the standard 106-mm rifle has a back-blast cone of 120 degrees with adverse effects to personnel within 100 feet of the breech.

Because the vehicle should be capable of becoming airborne within a minimum time after firing, the propulsion system should be functioning during weapon firing. There is *no* requirement for the weapon to be fired during flight, the Army declared.

Autorotative or power-off forward glide capability is desired in event of malfunction, but the "size and configuration of the vehicle should not be unduly compromised to obtain this capability," the Army said. Protective armor is not required. Quietness of operation is desirable to prevent detection, while a high-velocity downwash is not desirable because excessive dust would increase the risk of detection and injure the machinery.

No restriction was placed on selection of U.S. or domestic powerplants for the testbeds other than a requirement that they be proven engines to meet the timetable for development of the vehicle. "Although seemingly unlikely for this size vehicle, multi-engine reliability is desirable. Cost considerations do not necessarily eliminate the use of turbine power plants," the Army noted. Landing gear should be capable of rough terrain operation and research aircraft should be large enough to permit the mounting of weapons and equipment to investigate the concept.

Army R&D officials believe the ducted fan is probably the most feasible lift system for the vehicle they have in mind. They feel that shrouded rotors will be less liable to damage in low altitude operations and that collision with trees and other obstacles will accordingly be less critical to the health of the propulsion and lifting system.

• **The Army** is convinced there is at least one feasible design approach to the vehicle it wants, but does not rule out the possibility of many others. Army visualizes a flying jeep incorporating two ducts somewhat similar to the system employed by the Hiller Flying Platform. A pair of shaft-interconnected engines, either piston or gas turbine, would turn the two sets of rotors or blades at the same speed.

In the interest of simplicity, fixed-pitch blades are regarded as desirable, but adjustable-pitch blades may be necessary to assure stability. Directional control could be supplied by longitudinal and lateral vanes set beneath each duct and operated in opposite directions. (See illustration.) It is desired to avoid engine air bleed or power-hungry accessories for control purposes.

R&D officials are highly optimistic about the value of the aerial jeep as a new concept in weapons mobility and they are equally optimistic about the prospect of low-cost production of the machine once stability and control problems are ironed out.

One Army official said that interest in the competition has been expressed by the auto industry and expressed the belief that the machine will lend itself to the mass production stamping techniques used so successfully in the manufacture of automobiles.

The development timetable for the aerial jeep has not been outlined by the Army. Maj. Gen. Hamilton Howze, Army Aviation Director, has expressed the hope that operational models will be ready for troop test by 1959.

Some fast work will have to be done if this deadline is to be met. It permits less than two years for construction of one or more testbeds, evaluation of flight-test results, award of a production contract and actual production of a quantity of operational test machines. ◈◈◈

'Flying Crane' Using Allison T56 Engine

McDonnell Aircraft's "flying crane" development is using the Allison T56 engine, it has been learned.

The project, designated XHCH and started over three years ago under a Navy research and development contract, is proceeding "normally," a Navy spokesman said. Work is reportedly already under way on a prototype.

Cessna Delivers First Five T-37A Trainers to USAF

Four new Cessna T-37A twin-jet side-by-side trainers have been delivered to the Flying Training Air Force and a fifth to Eglin AFB, Fla. Starting March 11, students will transition from Beech T-34s to the twin-jets at James Connally AFB, Tex. The T-37 is powered by a pair of Continental J69 engines.

5 Reasons why

American Aviation World-Wide Directory

is your basic Advertising Medium!

▶ **IT IS USED CONSTANTLY**

75% of the recipients report they refer to the DIRECTORY 1 to 10 times daily.

▶ **BUILDS ACCEPTANCE FOR YOU**

In addition to the prestige gained by advertising in the publication for which your prospects pay the highest subscription price of any publication in the industry ($9 per copy), you are associating with the blue ribbon manufacturers of the aviation industry who are represented in the DIRECTORY.

▶ **ACTS AS YOUR PERSONAL SALESMAN**

At the psychologically right time . . . at the very moment your prospect is ready to buy.

▶ **WORKS 6 DAYS A WEEK, 6 MONTHS A YEAR**

The longest life of any reference book in the aviation industry . . . the most authentic, accurate data available anywhere.

▶ **ONLY 7/10-OF-A-CENT PER 100 CALLS**

. . . the most effective and the most economical advertising buy to cover the aviation industry.

Ask any of our 79 advertisers

in from 5 to 33 consecutive issues

Reserve Your Space NOW

There is a 65% turnover in personnel in our industry. The DIRECTORY keeps you up-to-date with a list of 26,000 names of executives and companies serving all phases of aviation. It is the only publication rendering this complete service.

American Aviation Publications, Inc.

Advertising Offices: 17 East 48th Street, New York 17, N. Y.
Publishing and Editorial Offices: 1001 Vermont Avenue, N. W.
Washington 5, D. C.

ADVANCED PROPULSION SYSTEMS and EQUIPMENT from a new subsidiary of CURTISS-WRIGHT

The successful development of aircraft and missiles to guard America's security demands the highest order of creative thinking plus a finely-tuned sense of responsibility. A unique blending of these essential qualities with the will and facilities for accomplishment enables Propulsion Research Corporation to solve propulsion problems created by fantastic speeds and altitudes.

Whether developing advanced propulsion systems or the smallest possible axial blower, PRC engineers and scientists work in teams in an intellectually stimulating environment. Projects receive the benefit of impressive resources in research, analysis, design, prototype fabrication and test, and manufacture.

Current programs include engineering, research and development in the turbo machinery and related fields, and development and production of aircraft accessories. Underway are projects in specialized centrifugal and axial flow blower fans, turbo pumps, turbines, fluid pumps, valves, auxiliary power units and cabin conditioning units.

In solving critical technical problems of precision components for aircraft and missiles, PRC is pacing America's progress in the air . . . and into space!

PROPULSION RESEARCH CORPORATION
A SUBSIDIARY OF
CURTISS-WRIGHT
CORPORATION • SANTA MONICA, CALIFORNIA

Schriever Punctures Missile Misconceptions

Air Force Western Development chief tells IAS meeting U.S. is "long way" from pushbutton warfare, has no 'all-purpose' missile.

The guided missile picture was brought into realistic focus last week by Maj. Gen. Bernard Schriever, head of the Air Force Western Development Command, who wanted to correct exaggerated impressions that "we have more and better guided missiles in the military inventory than is actually the case."

In what appeared to be a major policy address before the Institute of Aeronautical Sciences in New York, the WDD commander stressed five points to bring the missile program back down to earth:

• U.S. is a long way from pushbutton warfare with guided missile weapons systems still in infancy and "subject to many growing pains."

• There "is no such thing" as an all-purpose guided missile and the military services "must expend a great deal of effort in the development of various types of missiles . . . in support of different military objectives."

• Air Force requiries the largest variety of missiles "in view of the broad scope of its responsibilities with respect to aerial warfare."

•"Steady progress is being made" toward bringing an "increasing variety of special purpose missiles" to "operational readiness."

• Air Force now has several types of guided missiles available "in quantity for immediate use if necessary."

Schriever frankly declared that the cost of the entire military missile program is "staggering and still going up." Because of this, he said, the services cooperate closely in exchanging information, know-how and equipment. While he acknowledged that there have been "occasional differences" of opinion over specific types of missile weapons, he felt that "it should be made clear that the diifferences, whenever and wherever they occur, do not pertain to guided missiles as a category."

The "occasional differences" occurred, he explained, because of "a certain amount" of overlap in assigned missions, but he found them "not only unavoidable but highly desirable in order to preclude the possibility of gaps in the defense mechanism of this country."

Lt. Gen. James Gavin, Army's chief of research & development, echoed the cooperative theme in a later talk when he pledged "enthusiastic support" to the Navy and Air Force in efforts to obtain needed missiles "through development in every way we possibly can."

Gen. Gavin seemed to offer the facilities of Redstone Arsenal and the Army Ballistic Missile Agency, when he stated that the Army "will continue to assist our sister services in every way that it is humanly possible to do so" and "will enthusiastically enter into any program that will be of assistance to them."

Neither of the speakers at any time gave any indication of the predicted eruption over the Air Force's Thor and Army's Jupiter IRBM projects with unconfirmed Air Force plans to wipe out the Army program in favor of its own.

Both, however, expressed concern over the high cost of test firings of developmental missiles. Air Force answer is to gather all possible important data through the use of test vehicles for evaluating all components. Citing the X-7 for testing ramjets and the HTV for hypersonic tests on instruments, General Schriever revealed for the first time the existence of:

• Lockheed X-17, a re-entry test vehicle designed to provide "information on the problems which arise when the warhead of a ballistic missile reenters the atmosphere at terrific speed." Labeling the vehicle "highly successful," he noted that the use of a full-scale missile might be more spectacular, but much more expensive.

• North American X-10 is a research vehicle for the Navaho. It is provided with landing gear and "can

Highlights from IAS Speeches

Air Force (excerpted from speech of Maj. Gen. Schriever).

• Initial operational capability of ballistics missiles has been assigned to the Western Development Command, in a precedent-setting departure from procedures which have limited ARDC's responsibilities to research, development and testing of new weapons systems. For the first time, an ARDC unit will develop the operational environment to provide Strategic Air Command with complete weapons system.

• WDD will develop training facilities and techniques, operational installations, logistics support, etc. The activation of the first missile training base for missiles at Camp Cooke, Calif., is the first step.

• Thor tests at Patrick AFB are with the operational configuration with Douglas already fabricating Thor on production tooling. Thor powerplant is part of booster combination for Atlas.

• Atlas captive testing has already been conducted by Convair and at ARDC's flight test center at Edwards AFB.

• Martin Co. has invested $15 million in the Denver facility, to include area for large captive test and production sections for Titan. Aerojet-General has completed expansion of facilities to build the liquid-propellant rocket engine for Titan.

• Northrop supersonic, Snark "close" to operational stage, must be continued instead of accelerating Navaho devolepment "now in advanced stages" because U.S. now possesses no operational long-range surface-to-surface missile and much development and test work remains to be done on the Navaho. Production of Snark will insure that "we will have available at least one . . . missile of intercontinental range."

• Boeing Bomarc has been labeled "the most promising" air defense weapon in the surface-to-air class with "a considerably longer range than surface-to-air weapons presently in operational use."

• "Well over" $100 million has been invested just in powerplant development alone over the past 10 years for the Atlas and Thor missiles. Total facilities investment in the ballistics program to date is about $470 million. Sixteen prime contractors are involved and, together with study and other agencies reporting to WDD, are supported by a network of over 200 major subcontractors.

* * * * *

Army (Excerpted from speech of Lt. Gen. Gavin).

• Production of the La Crosse surface-to-surface missile was revealed for the first time. Propelled by a solid fuel rocket motor, it was developed by Cornell Aeronautical Laboratory and will be produced, under a recent contract award, by The Martin Co. Martin also will participate in the final development.

• La Crosse is described as a "deadly accurate" missile for close tactical support of ground troops in the field. It has an all-weather capability of destroying enemy strong points in the field to supplement air or artillery attack.

• Army has under development "quite a number" of surface-to-surface and surface-to-air missiles, apparently within the confines of the Wilson memo redefining the Army's missile role.

be recovered for repeated use." It has been "an invaluable source of important data."

Both, Schriever said, are examples of how to achieve economy in research.

Gavin, in turn, called for a "maximum amount of pre-launching" tests so that there will be "little doubt but that the missile will fly as planned when it is brought to the launching pad." Launching, he declared, "only serves to verify the result of all the prefiring calculations."

Any philosophy contemplating a missile development program parallel to that of manned aircraft, Gavin said, is "unnecessarily costly and frequently falls far short of its development goal."

He called the pre-launching test philosophy "a minimum risk program" as opposed to a "maximum risk" program, adding that "a maximum amount of testing and instrumentation and a minimum amount of firing should be the criteria of a good program."

In the specific WDD area of ballistic missiles, Schriever reported that "all major milestones" for the Thor, Atlas and Titan developments have "to date been passed on schedule." Lauding the mutual support and back-up concept used in the three projects, he asserted that "close cooperation and exchange of technical data among the three project teams serve to strengthen and accelerate the individual programs."

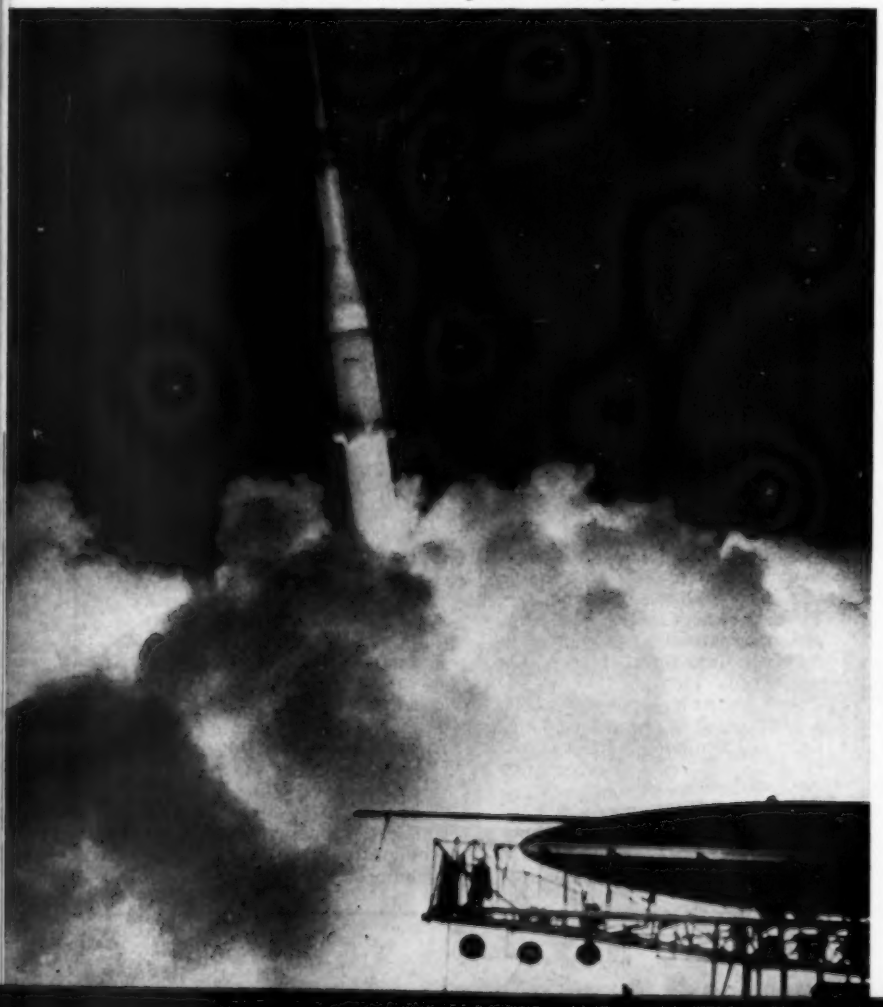
Without ever referring to the reports of the Thor blowup at Patrick AFB, Schriever issued a statement that appeared to be an attempt to deemphasize the incident. He said, in closing, "The broad breadth and great depth of the ballistic missile program assure ultimate achievement of our goal, without depending on one success or facing defeat on account of one failure."

Reiterating that neither the ICBM nor IRBM are "ultimate weapons," he also cautioned that neither will replace the manned intercontinental bomber. "But," he concluded, "it will undoubtedly become one of the most potent and convincing arms in our arsenal of strategic weapons systems."

◈ ◈ ◈

X-17 Blasts Off To Test ICBM Nose Cone

Air Force has released first pictures of Lockheed's huge X-17 test missile. Vehicles are being launched at Patrick AFB, Fla., to get information on re-entry problems that will arise in use of intercontinental ballistics missiles. X-17 is three-stage rocket, weighs more than six tons, stands high as a four-story building.



Only One ATC System Possible, Says Expert

The opinion that there can be but one system for the control of air traffic during either peace or war conditions was expressed by Col. S. A. Mundell, USAF, at the IAS meeting in New York.

Mundell, who is Deputy Chief, Electronic Supporting Systems Project Office, Air Research and Development Command, Wright-Patterson AFB, said wherever military aircraft fly there can be but one organization for their control and that of the airspace. An agency responsible for such control must be made up at least of the CAA and MATS' Airways and Air Communications Service, he said.

Pointing out that with increased speeds and operating ceilings every Air Force flight will in the near future be under IFR control, Mundell questioned whether the CAA would be large enough to control all the traffic expected. Their manpower would have to be doubled, he predicted.

To accomplish the task, Mundell believes the joint ATC agency must be "integrated" with the Air Defense Command during time of peace to insure continuity in wartime.

Missile Manufacturers Receive 'DX' Priority

The super "DX" priority rating has been assigned by Business and Defense Services Administration to companies engaged in the Atlas, Titan, Thor and Jupiter ballistic missiles development programs.

A DX rating assures the customer of first place on the delivery schedule of a vendor, ahead of other defense contractors with DO ratings, as well as all non-rated civil orders. DX can be applied to any order by a ballistic missile contractor or subcontractor for any component or maetrial except mill shapes of steel, copper or aluminum. These are allocated separately through the Defense Materials System.

Under the new procedure, a supplier receiving a DX order must notify the customer within five days whether or not he can accept the order. He must also notify other customers when their orders are displaced by super priorities.

Temco Gets $16-Million Missile Weapons Order

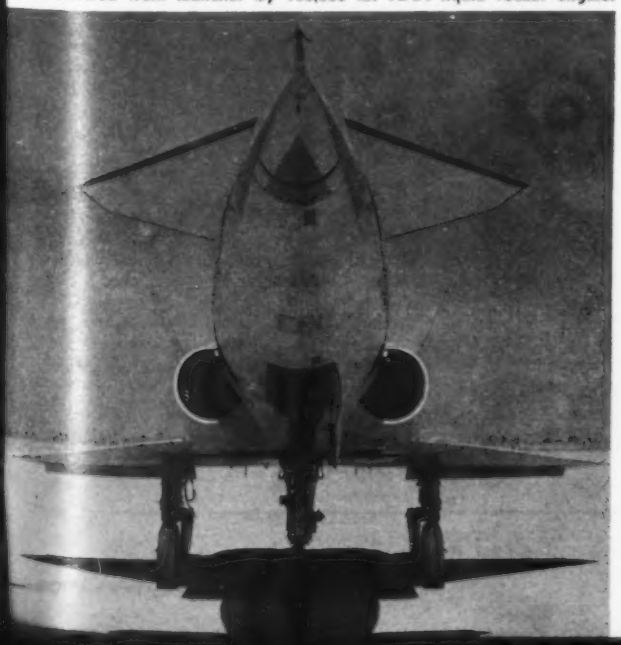
Temco Aircraft Corp. has received a $16-million Navy contract for design and development of a new guided missile weapons system. The Navy refused to reveal any details.

Temco said this is the third Navy prime contract it has received in less than seven months. The others cover its TT-1 primary jet trainer and its XKDT-1 rocket-powered target drone.

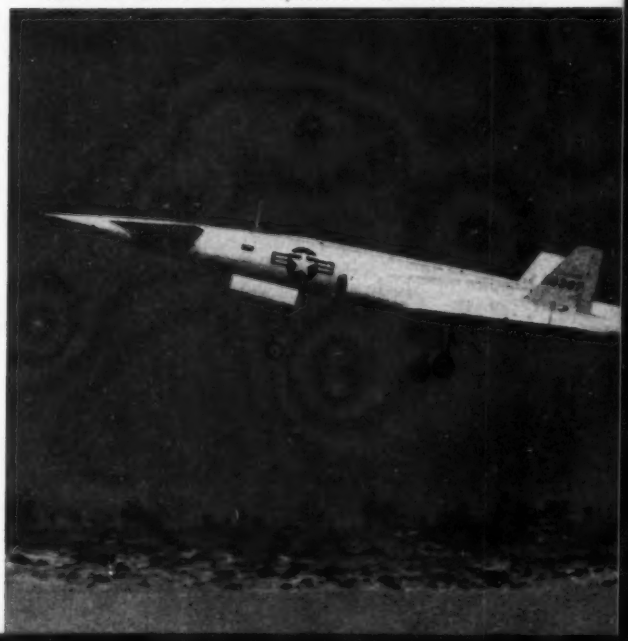
First flight photo of North American's X-10 test vehicle for Navaho intercontinental missile shows clipped delta planform with canard control. NAA recently completed X-10 flight testing at USAF's Patrick AFB test center preparatory to start of XSM-64 Navaho program.

North American X-10 Navaho Testbed

Head-on view of X-10 shows mounting of two Westinghouse J40 turbojets above wing. Production Navaho will be gearless and will use two Curtiss-Wright RJ47 ramjets of 30,000 to 40,000 lbs. thrust boosted from launcher by 135,000 lb. NAA liquid rocket engine.



X-10 on final approach. Dark lines under canard control presumably indicate limits of travel for flight observation purposes. X-10 is recoverable and served as test vehicle for Navaho missile reportedly slated to achieve Mach 3 speeds at 75,000 ft. altitudes.



Nuclear Radiation Problems Get Airing

By WILLIAM BELLER

Nuclear aircraft materials, helicopter powerplant cooling and new developments in rocket-sled flutter tests highlighted technical talks at the 25th annual meeting of the Institute of Aeronautical Sciences in New York during the week of January 28.

In a discussion of materials in a nuclear environment, Captain A. J. Mione of the Wright Air Development Center answered the question of when we shall have nuclear-powered aircraft by asking a logical second question: When shall we have materials sufficiently resistant to nuclear radiations?

Mione pointed out that about 10% of the energy arising out of nuclear fission is given off as radiations, fission products, alpha particles, beta and gamma rays, neutrons and other sub-atomic energies. To protect an aircraft crew from these radiations, a highly absorbing shield could be designed to encase the nuclear reactor.

Unhappily, such a shield, which would make life tenable for the crew, would also make the aircraft too heavy to take off. A compromise could be made by dividing the shield weight, wrapping part of it around the crew's compartment and another part of it around the reactor. Because of the inverse square law of attenuation and dispersion of radiation, a lower overall shield weight would result. Unfortunately, this solution would permit some of the radiations to escape and contaminate the aircraft.

The development of materials able to resist these radiations calls for a thorough examination of all materials able to sustain themselves in a nuclear environment. Only in this way can the shielding weight be reduced enough for a nuclear-powered aircraft to take off.

• **The tolerance of materials** to nuclear radiations can be measured in terms of gamma photons/cm^2. (400 roentgens or about 10^8 gamma photons/cm^2 is considered lethal for humans.)

Mione defines the threshold of damage to materials as that point where some change in the physical, chemical, or mechanical property of the material undergoing test is detectable. The functional threshold is defined as that point at which some critical property of the material has deteriorated beyond application requirements.

Crystalline materials, metals and ceramics, being relatively insensitive as a class to nuclear radiations, have a high threshold of damage of nearly 10^{19} gamma photons/cm^2 and therefore are not appreciably restricted in their applications in a nuclear environment. However, radiation concentrations thousands of times lower than those that would merely be detectable in metals and ceramics can severely deteriorate and destroy non-crystalline organic materials.

In another paper, Vertol Aircraft Corp. engineer H. A. Wahl evaluated the energy loss in helicopter powerplant cooling. He said that by good design practice the cooling power load for a reciprocating helicopter engine can in some cases be reduced from 6% of the available power to 3%. Such a reduction would result in an increase in hovering payload of almost 400 pounds for a typical 1,400-hp helicopter. If a turbine powerplant were used, the cooling penalty could be further reduced to 0.7% of the available power.

Reductions in the cooling power required may be made on several fronts: (1) improving cooling airflow characteristics, (2) increasing allowable operating temperatures, and (3) using lower heat-loss powerplants.

The airflow characteristics can be improved by careful ducting design, by lowering the fan axial-velocity and by venting the cooling resistance.

• **The aircraft designer** cannot increase the engine operating temperature because it is set by the engine manufacturer. However, the transmission-oil operating temperature can be increased although it is best for it to have a value between 180° and 220°F. This limit is usually imposed by physical problems such as satisfactory oil-seal life.

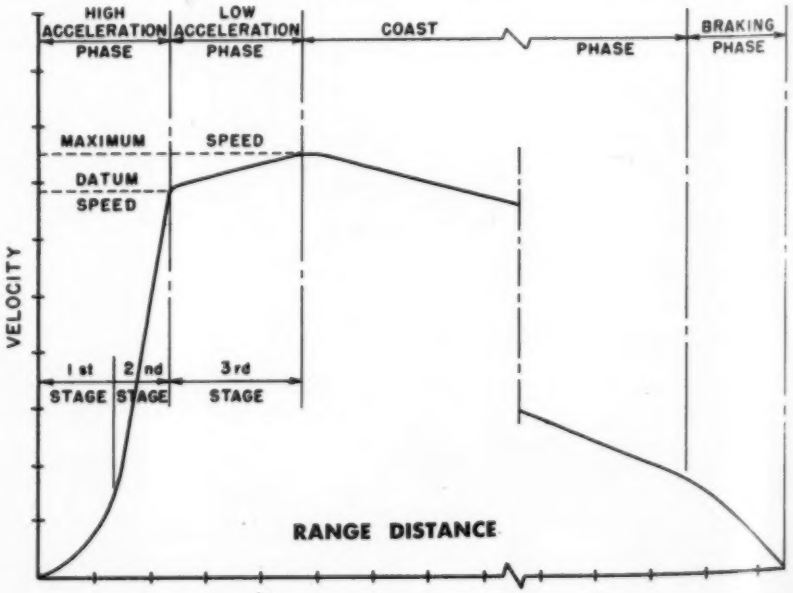
For the example of the 1,400-hp reciprocating-engine helicopter, where three transmissions are rejecting a total of 1500 BTU/min. and where conventional aircraft aluminum plate oil coolers are used, an increase in oil temperature from 180° to 240°F provides an equivalent power saving of 3 hp, or a payload increase of 30 pounds. If the 1,400-hp helicopter is powered by a free-turbine engine instead of by a reciprocating engine, the total heat rejection of the system would be cut from 19,500 to 3600 BTU/min.

Rocket-propelled sleds are being increasingly used in flutter-design analyses. The techniques were surveyed by North American Aviation engineers W. R. Laidlaw and V. L. Beals, Jr.

In a rocket-sled flutter test, the test component is mounted on the vehicle in a manner that reproduces the actual aircraft installation. This is true not only for the attachment structure but also for the control system, which should be completely operative and comprise the necessary actuating devices and accessories. In some cases, a major portion of the aircraft may have to be installed.

• **A typical sled run** comprises the following phases: (1) one or more initial acceleration phases, (2) a final low acceleration phase terminating at the maximum speed desired for the run, (3) the coast phase, and (4) the braking phase.

Tests are run at successively higher speeds until either flutter is obtained or until the component exhibits a satisfactory margin of structural safety. Adequate excitation of the lifting-surface normal modes is obtained from the small random vertical and lateral



Velocity-distance plot of typical rocket-sled flutter run.

motions of the test carriage.

Good instrumentation and data reduction is essential for all test runs. This includes not only measuring the motions of the lifting surface during the entire high-speed portion of the run but also making a continuous record of range time, distance, velocity and acceleration.

One disadvantage to the rocket-sled method is said to arise because the data is applicable only to an aircraft flying at an altitude corresponding to the altitude of the test facility. However, if necessary, it is possible to predict altitude effects by theoretical means. It may not be necessary because in most practical cases the critical flight condition for flutter occurs in the transonic range at low altitudes, which approximate the test environment.

The greater disadvantage stems from the extremely short test periods obtainable on even our longest ranges. This situation requires a carefully programmed speed-time history of the sled to ensure that a steady speed build-up is achieved from one test run to the succeeding one. It is expected that the next step in the rocket-sled program will be that calling for full-scale flutter testing.

Electrolytic Tank

A 30-year old testing technique—the rheoelectric analogy method—was revitalized at the Institute meetings by Sorbonne professor Lucien C. Malavard, one of the world's leading workers in the field of circulation control and its associated problems. The method comprises an electrical analog of an aerodynamic object submerged in an electrolytic tank or conducting paper, which is explored by means of twin probes.

The method is being used currently to solve two types of problems. In the first type, the engineer sees a graphical representation of a given flow, tracing out for example the streamlines about an object. These are identified in the analogy with the equipotential lines found in the electrolytic tank. In this way, the engineer is able to get an image of the flow, the relevance of which is comparable to that of his viewing the air flow about the aerodynamic object in a smoke tunnel.

In the second type problem the analogy method can be used as a calculating machine to obtain practical solutions to certain types of mathematical equations. Here the experimental set-up constitutes an analog calculator where the data and the results are viewed as electrical quantities.

• **Examples** of recent work done in the electrolytic tanks include (1) the direct plotting of the constant velocity lines of plane flow fields, (2) analog calculations of the aerodynamic characteristics of a wing subjected to blowing at the trailing edge (jet flap), and (3) analog calculations for the annular wing.

Malavard illustrated the rheoelectric analogy method in terms of the direct plotting of a velocity field. Briefly stated, the two-dimensional flow of a perfect incompressible fluid consists in identifying the velocity potential or the stream function with the electrical potential in a plane tank. In the former case, the model of an obstacle in the flow is insulating; in the second, it is conducting with a constant potential.

To obtain the velocity at a point in the flow, the electrical gradient must be determined at the corresponding point in the tank. This is done by means of two very closely spaced probes between which the potential difference is measured. This potential difference is always quite small, and it is necessary to amplify it considerably. Only a carefully designed apparatus will give correct results.

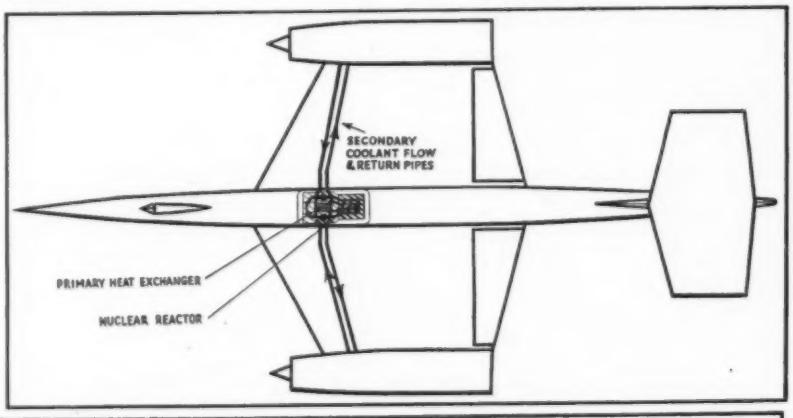
The electrolytic tank is a means of study as well as a means of calculation. "Viewed from this angle," Malavard said, the method "bears in relation to the large calculating machines the same relationship that a small laboratory windtunnel bears to the large windtunnel destined for industrial use."

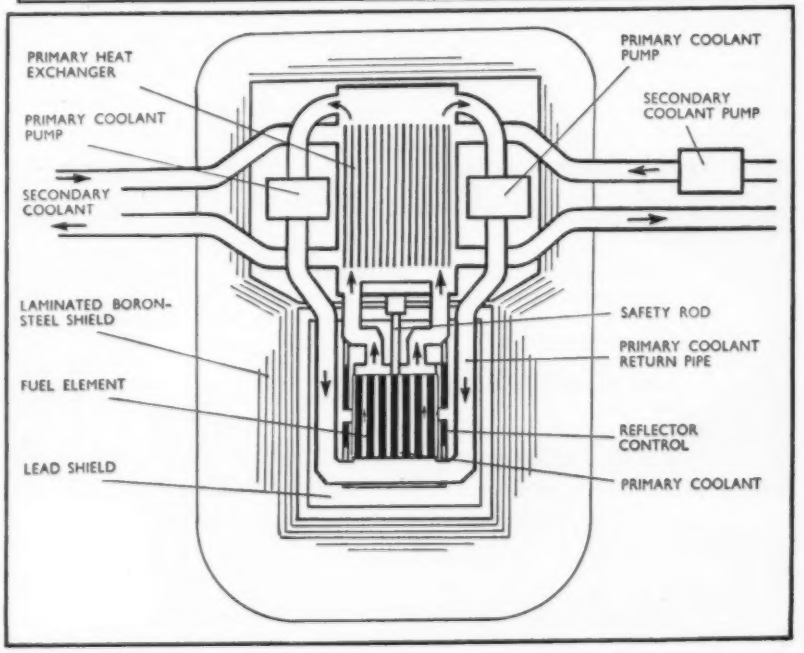
Nuclear-Powered British Aircraft and Reactor

These illustrations of a nuclear-powered supersonic aircraft (top) and a liquid metal-cooled aircraft reactor were published in the *Hawker Siddeley Review*. The Hawker Siddeley Nuclear Power Co. is one of the organizations in Britain that is studying the problems of nuclear power for aircraft.

Discussing the application of nuclear power to aircraft, the *Hawker Siddeley Review* says that low weight and space are the essentials. It continues:

"At present a fast reactor with highly efficient liquid metal heat extraction would seem the most suitable system, although there are strong arguments in favor of a gas-cooled system even at the expense of some increase in size. The crux of the aircraft problem is a successful evolution of the concept of partial shielding but, even so, such aircraft will be large with all-up weights probably greater than 100,000 lbs."





Are We Losing Airpower Race to Reds?

By CHARLES SCHAEFFER

Disciples of the gloom-and-doom philosophy picturing U.S. airpower as woefully inadequate in the face of growing Soviet air might last week were fingering Senator Stuart Symington's widely-heralded report. It was, ostensibly, proof of their case.

But was it? That's what critics of the Symington subcommittee approach were asking. Expecting new, or at least cogent observations on what the U.S. might do to overcome the lag, they said they got instead a playback of previously-published testimony, some of it good.

What the Symington Air Force Subcommittee reported was pretty much as informed persons guessed last spring after testimony by some of the nation's top military men: The Soviet Union has outstripped this country in the production of heavy bombers of the B-52 class and it is "closing the gap" qualitatively in other areas.

With the exception of Massachusetts Republican Leverett Saltonstall, the subcommittee chastised the Defense Department across the board. Taken at face value, the report drew an outline of inadequacy that found:

- The U.S. lacking long-range modern jet bombers and a program to produce them in sufficient numbers.
- A U.S. increasingly vulnerable to air attack.
- The Defense Department falling down on the job of developing an adequate defense warning system.
- Duplication and even triplication of many research and development programs, resulting in delay and waste in the missile field.
- A weakened airbase structure, providing neither the alert status nor the dispersal necessary for security.

"This deficiency in the continental United States is becoming increasingly dangerous because of the current deterioration in our overseas base structure, along with the growing long-range capability of Soviet aircraft, the report warned.

Majority subcommittee members Symington, and Senators Jackson (D-Wash.) and Ervin (D-N.C.) agreed that the U.S. has the capacity to produce enough jet tankers. But, they said collectively, the present inadequate program is seriously hampering the effectiveness of our airpower.

Say U.S. Is Losing Ground

Naval air power, according to the subcommittee, cannot significantly overcome the comparative decline in the strategic striking power of our Air Force. The Senators also saw the Soviets outpacing us in the rate of technological development, training facilities, in speed and quantity of prototype development, and in the training of scientists and engineers.

If it was this bad, what was the remedy? Proper programing and administration, said the subcommittee, can produce air supremacy, and it can be accomplished without upsetting the economy or imposing new burdens on the taxpayer.

What the people don't know about Soviet airpower also concerned the subcommittee. "If any conclusion could be singled out for special attention," the report noted, "it might well be the importance of taking prompt steps to see that the American people are given more of the truth about the relative strength of the United States as against that of the Communists."

• **Sen. Saltonstall,** who sat through three months of hearings with his Democratic colleagues, apparently witnessed the proceedings through different glasses. Not only did he find the U.S. well equipped in the air, on the ground and at sea, but also superior to the Soviets. In a minority report, he twitted the Democrats for their "unduly pessimistic" view of the defense posture.

Largely ignored by the majority members, Sen. Saltonstall charged, was testimony endorsing the strategic qualities of the B-47 and our overseas base structure. "Our powerful fleet of bombers, which can deliver thermonuclear weapons, comprises t o d a y—now—striking power unequaled on the face of the globe," he said.

The Massachusetts legislator conceded the importance of the B-52. But, he maintained, "the B-47 will be of tremendous value for several years to come."

Other developments:

• Defense Secretary Charles Wilson, testifying before the House Armed Services Committee, defended the nation's $38.5 billion defense budget as a "sound resolution" of conflicting demands. He conceded it would be difficult to hold the level of spending within $40 billion a year during the next three years.

Wilson estimated that the military budget for fiscal 1959 would exceed $39 billion. But the Defense Chief foresaw no important gains or reductions in military expenditures barring outright war.

• Before the same committee Army Secretary Wilbur M. Brucker defended Wilson's November order restricting the Army's role in development of guided missiles. In response to sharp questioning, he said the Army "for the time being" will continue to develop the IRBM Jupiter missile.

Statements by Brucker and Army Chief of Staff Maxwell Taylor revealed that the budget had been trimmed from an original request of $11.3 billion to $9.7 billion.

• Admiral Arleigh A. Burke, Chief of Naval Operations, told the Committee the Navy had earmarked 92% of its fiscal 1958 aircraft funds for the purchase of combat planes. Although the bulk of new procurement with fiscal 1958 funds will go for the purchase of jet aircraft, he said, the Navy intends to continue operating "a significant number of reciprocating-engine aircraft."

• A probe to determine if there was a "deliberate policy" to slow down development of an atomic-driven aircraft was proposed by Sen. Henry Jackson (D-Wash.) and Rep. Melvin Price (D-Ill.), members of the Joint Congressional A t o m i c Committee. Jackson said lack of money was not the real reason for the stretchout—and that he wanted to get to the bottom of the delay.

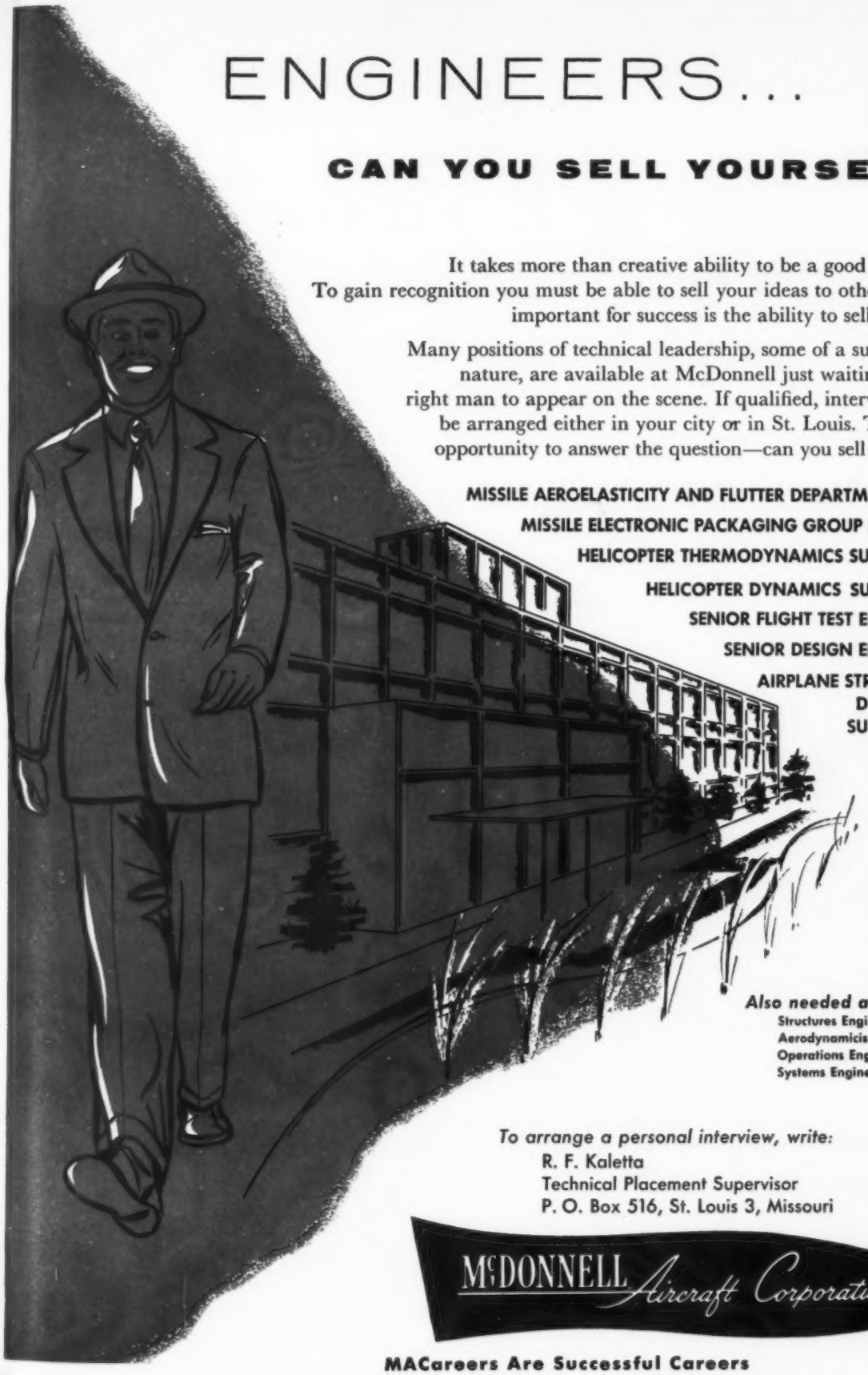
• Meanwhile, the Atomic Energy Commission disclosed that it had successfully powered a turbojet engine exclusively by heat from an experimental reactor. In its 21st semi-annual report to Congress, AEC hailed the laboratory model test run as a "significant advance toward the ultimate goal of achieving atomic-powered flight." ◆◆◆

People who know . . .
stay at the
Hotel Lexington
• 3 Minutes from Grand Central
• Convenient to Fifth Avenue Shopping
• All Outside Rooms ; Tub and Shower
• Radio; Television; Circulating Ice-Water
HOME OF THE FAMOUS
'Hawaiian Room'
• Superb Food at Modest Prices
Near the United Nations
LEXINGTON AVE. at 48th ST., NEW YORK CITY, 17

"NEW YORK'S FRIENDLY HOTEL"

See your local travel agent or write
Promotion Department for Brochure 144

FOR RESERVATIONS AND FURTHER INFORMATION PHONE:
CHICAGO: DEARBORN 2-4432 BOSTON: HANCOCK 6-6625 MIAMI: FRANKLIN 9-8331



ENGINEERS...

CAN YOU SELL YOURSELF?

It takes more than creative ability to be a good engineer. To gain recognition you must be able to sell your ideas to others. More important for success is the ability to sell yourself.

Many positions of technical leadership, some of a supervisory nature, are available at McDonnell just waiting for the right man to appear on the scene. If qualified, interviews can be arranged either in your city or in St. Louis. This is an opportunity to answer the question—can you sell yourself?

MISSILE AEROELASTICITY AND FLUTTER DEPARTMENT HEAD

MISSILE ELECTRONIC PACKAGING GROUP ENGINEER

HELICOPTER THERMODYNAMICS SUPERVISOR

HELICOPTER DYNAMICS SUPERVISOR

SENIOR FLIGHT TEST ENGINEERS

SENIOR DESIGN ENGINEERS

AIRPLANE STRUCTURAL DYNAMICS SUPERVISOR

Also needed are:

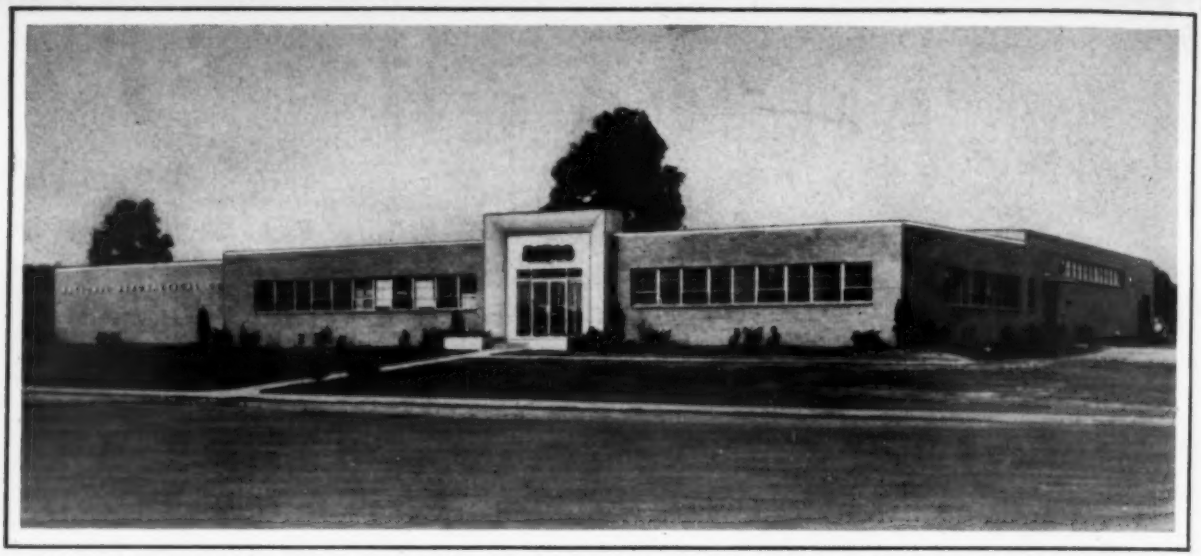
Structures Engineers
Aerodynamicists
Operations Engineers
Systems Engineers

To arrange a personal interview, write:

R. F. Kaletta
Technical Placement Supervisor
P. O. Box 516, St. Louis 3, Missouri

McDONNELL *Aircraft Corporation*

MACareers Are Successful Careers



National Aeronautical Corporation's new 25,000 square foot plant in Fort Washington Industrial Park near Ambler, Pennsylvania.

THERE MUST BE A REASON...

National Aeronautical Corporation Built its new Aviation Electronics Plant

IN PENNSYLVANIA

"Our new plant is already exceeding estimates for productivity and efficiency" says Mr. James Riddle, President of National Aeronautical Corporation. Contributing to Narco's continuing growth and prosperity have been the benefits of its *location*, as Mr. Riddle tells why his company built two plants *in Pennsylvania* within the past 10 years.

1. "Highly technical assistance for our engineers is readily available from many suppliers in the easy-to-reach Philadelphia area.
2. "Our strategic location, near the geographic center of a vast number of electronics industries, assures direct savings in time and money.
3. "The Pennsylvania Turnpike, its Northeast Extension, and a network of other good highways are adjacent to our plant.
4. "Fast freight and air transportation, by common carriers, is available to all parts of the country.
5. "Our employees enjoy the pleasant advantages of quiet suburban living.

"And most important has been the *favorable business atmosphere in Pennsylvania*, which has made possible a growth from $36,000 in sales during 1946 to an expected $3,000,000 this year."

For a detailed analysis of these advantages and services, *prepared in confidence for your individual plant needs*, write or call—

Pennsylvania Department of Commerce
Main Capitol Building, 445 State Street
Harrisburg, Pennsylvania
Phone: CEdar 4-2912

Special reports and tabulations, tailored to your specific location requirements, will be prepared upon request by engineering and economics specialists, covering:

Labor—Availability, skills, rates, surplus areas.

Markets—Consumer, industrial product, state, regional.

Transportation—Water, rail, truck, air transit time, costs.

Building—Availability, sizes, location, descriptions.

Sites—Acreage, topography, utility services, photos, maps; industrial districts.

Financing—Community-state industrial building program, lease-purchase, commercial credit.

Materials—Metals, industrial chemicals, wood, textiles, farm products.

Minerals—Location, reserves, potentials, analyses.

Water—Quantitative, qualitative analyses.

Power—Capacity, network, industrial services, costs.

Fuel—Coal, oil, natural gas service, costs.

Engineering—Schools, enrollment, specialization, research laboratories, services.

Taxes—Inter-state and community comparisons, assessment ratios, millages, corporate.

Communities—Characteristics, size, regions, housing, schools, culture, recreation.

Industrial Representatives Available for Inspection Tours, Conferences and Consultations

Better Organization is Main Key To Aviation Planning, Says Curtis

The pattern of the nation's future aviation facilities program, strongly emphasizing a solution to the knotty air traffic control problem, is beginning to take shape.

Although formal recommendations for the master plan are not due at the White House for several months yet, key figure in its development—Presidential aide Edward P. Curtis—has disclosed some hint of major changes in store.

In recent speeches before the Society of Automotive Engineers in Detroit and the Institute of the Aeronautical Sciences in New York, Curtis highlighted these general features of what he will recommend for future aviation planning:

• Better organization—a simpler, more authoritative form of organization must be devised to control both research and operations in administering a future civil-military ATC system.

• User charges—At least a portion of the cost of operating future ATC facilities should be borne by the users. Present 2¢ Federal avgas tax is a step in the right direction, but additional revenue of this type should be considered.

• Three-stage program—Orderly transition from what we have today will start with general use of techniques now known, but either not used or only in limited service. Stage two will extend to improved procedures using present-day technology, with the final stage dealing with areas in which further R&D and testing will be needed on a continuing basis.

Organization Problem

Curtis views the organization problem as foremost. The only mechanism we have today, he notes, is the complicated maze of committees which try to resolve conflicts as they arise. The result—major problems tend to drag out to the point where finally the only possible solution is an unsatisfactory compromise.

Curtis feels this is particularly critical in R&D for a common ATC system where the military services tend to work on system to meet their own peculiar needs, but which may or may not be compatible with what CAA is developing.

Curtis makes no pretense that his group will come up with some magic formula that will solve these problems overnight. But this, he says, certainly doesn't mean that the problems are insoluble. Quite to the contrary, there is the equivalent to a magic formula in a systems development organization backed by the best talent in government and industry and set up to work constantly on ever-changing ATC problems.

• **Backbone for** the master-plan being developed by the Curtis group is a comprehensive study of volumes and types of civil and military traffic to be expected in the next 20 years. Results of the study, although not yet complete, reveal these findings:

Today 57% of airline transports carry 40 or fewer passengers and 43% are 40 to 80 passenger aircraft. By 1962, 68% of airline fleets will carry 40 to 90 or more passengers. Of the total, 25% will still be piston-powered, 75% turbine-powered.

By 1975, 90% of passenger trunkline fleets will be turbine-powered, of which about 40% will be large jets seating 90 or more passengers. Although the total number of airline transports probably will not increase much in the next 20 years, larger and faster jets and turboprops will generate a tremendous increase in miles flown and the number of landings and takeoffs will jump accordingly.

As a yardstick for nationwide airline traffic growth, the Curtis group cites an expected 37% increase in operations at New York from 475,000 in 1956 to about 650,000 by 1975.

Performance-wise, the study shows, present piston transports cruise between 150 and 300 knots at altitudes from 5,000 to 22,000 ft. Turboprops operating in the 1960s and 1970s will cruise at about 350 knots and 10,000 to 25,000-ft. altitudes, and such jets as the Boeing 707 and Douglas DC-8 will cruise at 450 to 550 knots between 20,000 and 35,000 ft.

Before 1975, indications are it will be technically possible to design and build a supersonic jet but operating costs could well be substantially higher than present subsonic jets. If such an airplane appears by 1975, it probably will fly at Mach 2 to Mach 2.5 speeds and altitudes of about 55,000 ft.

• **Some time** during the next 20 years, at least one prototype nuclear-powered plane undoubtedly will be developed. Although its range presumably could almost be classed as unlimited, the Curtis group finds it difficult to assess the A-plane's potential in the civil aviation field. At least, due to many complex problems of safe handling of nuclear powerplants, such an aircraft will have to be handled under very special conditions, certainly quite apart from facilities used today.

In the field of general aviation, a much greater rate of increase in numbers of aircraft and aircraft movements is foreseen. The Curtis group views a possible four-fold increase over the approximate 63,000 aircraft of 1956 to some 252,000 by 1975.

Rounding out the 20-year forecast, the Curtis study indicates military aircraft numbers will be on a gradual decline over the years as various types of missiles are developed and introduced to replace manned aircraft. ◈◈◈

WANTED: TODAY'S ENGINEERS FOR THE POWER PLANTS OF TOMORROW
Continental J69 Turbo Jet Engine
To implement Continental Aviation and Engineering Corporation's job—research and engineering aimed at producing the power plants of the future—a program of expansion is under way. The company has openings for qualified engineers interested in permanent jobs with excellent opportunity for advancement. Working and living conditions are exceptionally fine. The CAE facilities are among the most modern and well-equipped; the recreational, educational and cultural advantages of the Detroit area are second to none.
IF YOU WOULD LIKE TO KNOW MORE about a career at CAE, write for this illustrated brochure outlining the company's role in research and engineering, and suggesting YOUR place in this organization.
ADDRESS: "TECHNICAL PERSONNEL"
CONTINENTAL AVIATION and ENGINEERING Corporation
12700 KERCHEVAL AVENUE
DETROIT 15, MICHIGAN
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

Circle No. 13 on Reader Service Card.

Douglas Plans $25-Million Debenture Issue

Statement filed with SEC shows need for new funds; other aircraft builders likely to try raising more operating capital this year.

By SELIG ALTSCHUL

Aircraft financing is off to a fast start for 1957. On the heels of a January $7.5-million convertible debenture offering by Rohr Aircraft Corp., Douglas Aircraft Company Inc. plans to seek from $25 to $30 million in new money this month.

(The need for this impending financing was first indicated in AMERICAN AVIATION, Sept. 24, 1956 and again on Nov. 19, 1956). Other aircraft companies are likely to soon follow the parade for additional capital funds.

The Douglas sale of convertible debentures, to be underwritten by an investment banking group led by Merrill Lynch, Pierce, Fenner & Beane, will be of particular significance in view of the test of public acceptance it may afford. This can importantly influence the measure and terms of subsequent aircraft financing that must assuredly follow this year.

• **In size,** the Douglas offering in the aircraft industry will be below the $40 million in convertible debentures sold by General Dynamics in 1955. It will, however, approximate in dollar amount the $30 million of Lockheed convertible bonds marketed in 1955 and the $31 million in convertible preferred sold by United Aircraft last year.

As filed with the Securities & Exchange Commission, the Douglas registration statement is most revealing and together with information obtained from other reports permits a pertinent analysis of company affairs.

How Funds Would Be Used

Douglas expects to apply the additional funds obtained from this financing for a series of purposes as follows:

• To finance increased investment in inventories occasioned in part by government policy of reducing progress payments.

• To help the company to be in a position to accept or undertake additional orders and projects for the Government.

• To maintain its financial ability to further advance the company's position in the development of commercial aircraft, particularly its jet transport program.

• For improvements for its properties and facilities.

That progress payments from the Government may have in fact been reduced can be seen from analysis of the inventory accounts. On Nov. 30, 1956, against $299.4 million of gross inventory items, $192.9 million or 64.4% had been received in the form of advance or progress payments leaving a net of $106.5 million in inventories. A year earlier, against $328.8 million in gross inventories, almost $253 million or 75% had been received, leaving $75.9 million net.

However, in the 1956 fourth quarter, Douglas managed to change previous target price-incentive type contracts into cost-reimbursement types. This adjustment, in addition to having a significant impact in increasing sales and earnings for the 1956 fourth quarter, may have also reduced the amount of its overall inventory accounts.

For example, sales under cost-reimbursement-type contracts are recorded as costs incurred, whereas sales under target price-incentive type contracts are not recorded until the articles are delivered. Of course, this acceleration of sales and earnings during 1956 will cause corresponding decreases to be reflected in subsequent years.

• **Moreover,** in a sense, financing of inventories is alleviated somewhat by the advance payments received by the company in excess of expenditure on related fixed price contracts. At the 1956 fiscal year-end, such advances aggregated $61.6 million and a year earlier $43.3 million. Applying these advances against inventory accounts would leave a net of $43.9 million at the 1956 fiscal year-end as compared with $32.6 million the previous year.

The company reports that it has an open line of credit aggregating $110 million with a group of seven banks. While subject to an annual review, this credit presently carries no commitment fee and will bear interest at the prime rate in effect at the time of the borrowing. Such choice conditions are rare and are a measure of the strong credit standing of Douglas. No borrowings are currently outstanding against this credit.

Need Increases

However, the need for capital remains a continuing and increasing one. During 1956 the company's expenditures for property, plant and equipment totaled about $23.6 million, almost double the amount expended for such items in any preceding year.

Moreover, projections indicate that such expenditures will be substantially greater in 1957. In fact, as of Nov. 30, 1956 future expenditures of $19.7 million had been authorized. Cash throw-offs from depreciation and amortization to meet these requirements have been relatively limited, amounting to $5.1 million, $6.6 million and $7.8 million in 1954, 1955 and 1956 respectively.

Douglas notes the extraordinary degree placed upon technological progress and that it "has spent and must continue to spend substantial sums of money for research, engineering development and testing in order to maintain a favorable competitive position in the industry." This is borne out by "experimental costs" jumping from $4.8 million in 1954 to $12.5 million in 1955 and almost doubling from that point to $24.4 million in 1956. Presumably much of these "experimental costs" went into the DC-8 project.

Company policy is declared to be to write-off experimental costs as they are incurred. It is also company policy to "cost out" production aircraft on a specific unit basis so that early deliveries of a model reflect the higher manufacturing costs inevitably associated with those deliveries. Consequently, with respect to a commercial model, it is not unusual for experimental costs to be followed by losses on delivery of the early production aircraft.

As manufacturing costs decline through operation of the "learning curve," deliveries should begin to show a profit which, if sufficient units are delivered, would be expected to ultimately offset the experimental costs and early production losses and result in a profit on the entire program.

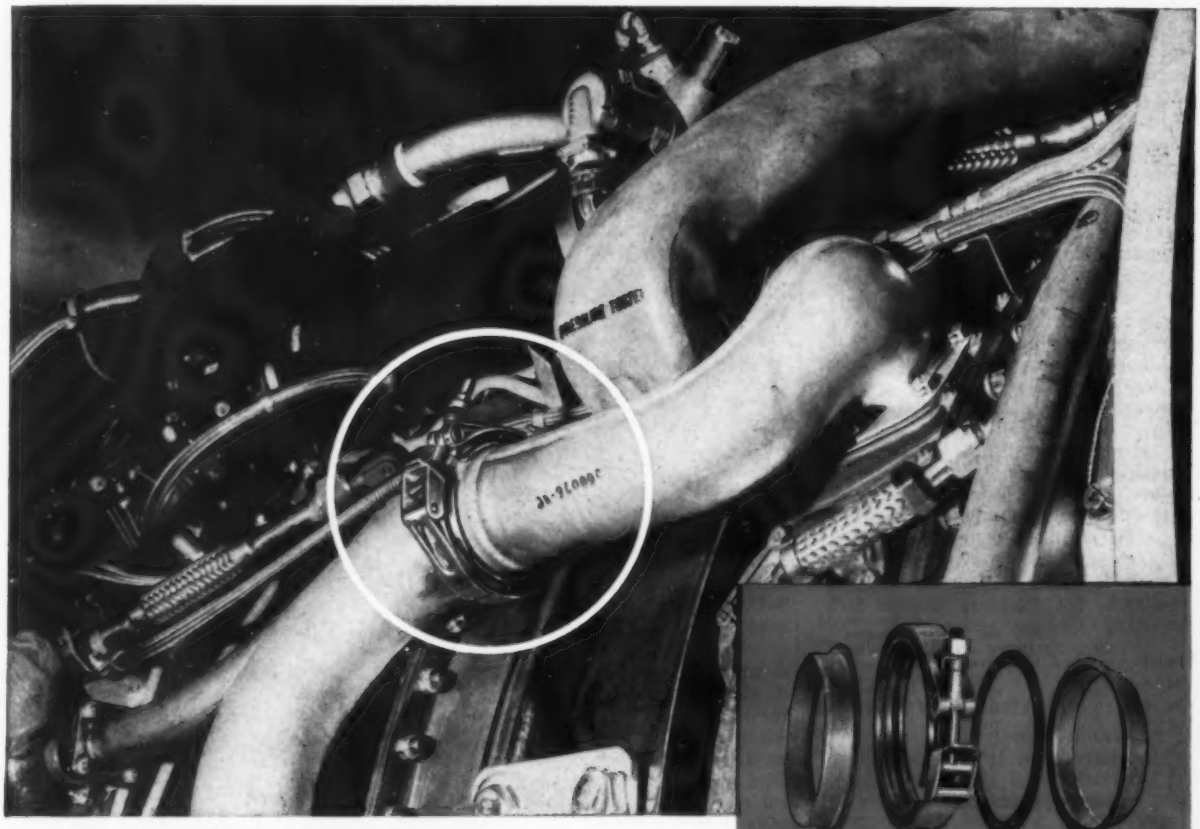
This is an important consideration to bear in mind in viewing the company's current commercial production runs as well as that projected for the DC-8.

Difficulties Recalled

As a result of the 1947 accidents involving DC-6's, the company reports that it spent more than $7 million to eliminate the difficulties to which such accidents were attributed. From 1946 to May, 1952, 174 DC-6 airplanes were delivered to domestic and foreign purchasers. In addition, up to January 4, 1957, 39 DC-6As and 213 DC-6Bs were reported as delivered.

This makes a total of 416 in the DC-6 series delivered thus far plus at least 105 on order. In a statement to the Hebert Committee last year, a Douglas official declared that more than 400 planes were delivered before the company broke even. Moreover, this official asserted that the company was $35 million "in the hole (on the DC-6) before we started to work out." This serves to indicate the costliness of a

Marman LIVE Joint Systems Speed Connection-Disconnection of Aircraft Tubing



Marman LJ11 LIVE Joint on a jet engine bleed air line.

Marman J11 LIVE Joint.

Marman J11 and LJ11 LIVE Joints are designed to connect AND10104 tubing and maintain a positive seal over a wide range of temperatures and pressures. When deflections are imposed on the joint by pressure loads or thermal stresses, the wedging action of the V-band coupling against the flange faces retains the metal-to-metal seal.

Compact configuration of high performance Marman LIVE Joints makes them superior to bolted flanges and B-nuts where installation accessibility and weight savings are desired. J11 and LJ11 Joints are available in O.D. tube sizes from 1" to 12". Temperature range is —300°F. to —1000°F., for pressures up to 2000 psi. Write for full information.

MARMAN DIVISION
Aeroquip Corporation

11214 EXPOSITION BLVD., LOS ANGELES, CALIFORNIA
IN CANADA: AEROQUIP (CANADA) LTD., TORONTO 10, ONTARIO
MARMAN PRODUCTS ARE MANUFACTURED UNDER VARIOUS U.S., CANADIAN AND FOREIGN PATENTS AND OTHER PATENTS PENDING

Circle No. 14 on Reader Service Card.

commercial transport program.

• **In 1953,** the DC-7, a "new and improved commercial transport," entered full production. As of January 4, 1957, 77 DC-7s, 40 DC-7Bs and 39 DC-7Cs, or a total of 156 in this series, had been delivered. It may be presumed that the DC-7 series benefited substantially from the development and engineering stemming from the DC-6 program and hence did not incur anywhere near the same development costs.

On this basis, the profit margins on the DC-6 and DC-7 series may now well be in a sharp upgrade. A Douglas official testified that the company's profit margins in commercial contracts when completed would come out around 12% before taxes. It is obvious, however, that no one can foretell the ultimate limit in commercial sales nor is there any assurance that break-even points will always be reached.

Since June, 1955 when the company entered the jet transport field and until January 4, 1957, it booked orders for 122 DC-8s. In a most straightforward declaration the company states that all of its operations are subject to unusual risk; and the "construction testing and marketing of a new airplane such as the DC-8 is a hazardous undertaking."

The company's backlog of commercial airplanes was as follows on January 4, 1957.

Model	No. on Order and Undelivered	Approximate Dollar Value (000 omitted)
DC-6A	37	$ 43,351
DC-6B	68	87,455
DC-7	29	55,688
DC-7B	70	137,964
DC-7C	74	171,321
DC-8	122	615,522
Totals	400	$1,111,301

This commercial backlog comprised almost 50% of the company's total orders of $2.2 billion at the 1956 fiscal year-end. This compares with but 10.4% in commercial bookings out of a same total backlog at the 1953 year-end.

Reported sales for the 1956 fiscal year hit a post war peak of $1,074 million as compared with $868 million for the previous year. Net income for 1956 came to $33.2 million or $8.96 per share as contrasted to $28.2 million or $7.65 per share for the previous year.

• **It has** also been disclosed that the Regional Renegotiation Board in Los Angeles has recommended that the company's gross earnings for fiscal 1952 were excessive in the amount of $9 million. If upheld by the Renegotiation Board in Washington this ruling will reduce net earnings after all taxes and credits to $2,240,000.

Thus Douglas, along with Boeing and North American, among others, is now faced with possible refunds on previous years' earnings. However, it appears that Douglas may have included $1 million in its tax provision for 1956 to help provide for such contingency.

Considerable additional information as to the company's historical development and current position is revealed in the Douglas registration statement. All in all, it is an account of a successful company stated in a matter-of-fact manner. ◈◈◈

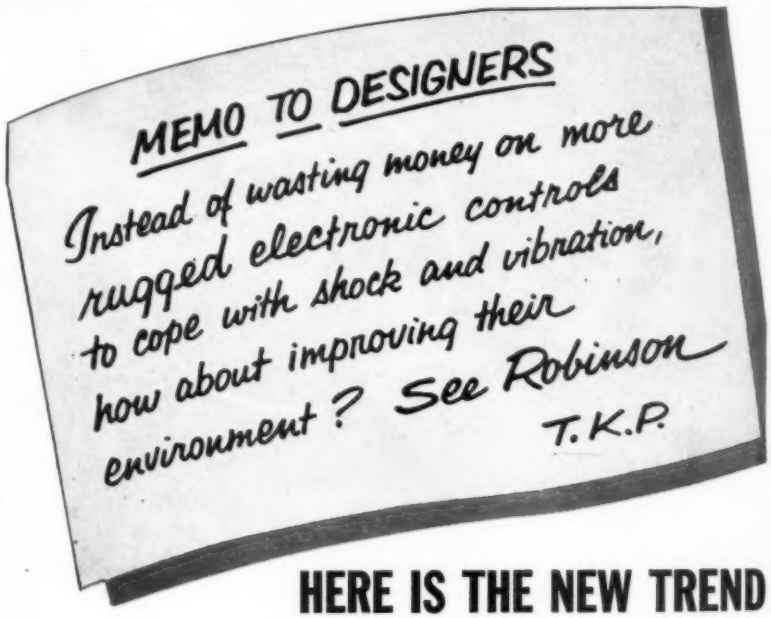
Financial Briefs

• **North American Aviation Inc.** had $9,898,000 net income for the first quarter ended Dec. 31, against $7,100,000 net in the same 1955 period.

• **Menasco Mfg. Co.** reported $410,914 net on $10,909,676 sales in the first half of its current fiscal year, ended Dec. 30, as against $297,415 profit on $8,379,197 sales in the same period of the preceding year.

• **Beech Aircraft Corp.'s** commercial and military sales exceeded $20 million in the first quarter of its 1957 fiscal year, ended Dec. 31. This was a 17.5% gain over the same 1956 quarter, when sales totaled $17 million. Backlog continued at over $100 million.

• **Cessna Aircraft Co.** expects 1957 sales to approximate 1956's record $66,300,000, but profits will be somewhat reduced because of increases in military and decreases in commercial sales. President Dwane Wallace said profit margins are "considerably less" on military business.


MEMO TO DESIGNERS
Instead of wasting money on more rugged electronic controls to cope with shock and vibration, how about improving their environment? See Robinson
T.K.P.

HERE IS THE NEW TREND

in the protection of electronic controls for jet aircraft, guided missiles, and rockets by improving their shock and vibration environment.

ROBINSON
ENVIRONMENTAL IMPROVEMENT through ENGINEERING
MET-L-FLEX

VIBRATION CONTROL IS RELIABILITY CONTROL

ROBINSON AVIATION INC.
TETERBORO, NEW JERSEY
Vibration Control Engineers
AIRBORNE DIVISION

WEST COAST ENGINEERING OFFICE 3006 WILSHIRE BLVD., SANTA MONICA, CALIF.

Circle No. 13 on Reader Service Card.

Better Planning, Fewer Projects Needed, German Expert Tells British Engineers

SOUTHAMPTON, ENGLAND—The effects of increased aircraft complexity on the industry were discussed by a German expert, Karl Frydag, at the British Institution of Production Engineers' annual "Problems of Aircraft Production Conference" here.

Frydag, director of Henschel & Sohn, said that with today's complex airplanes and the relative shortage of high-grade technicians every country faces three requirements:

- Comprehensive long-term planning based on a complete, careful analysis of all contemplated developments.
- Concentration upon a limited number of projects.
- Strict adherence to the selected projects and their development to the utmost of their possibilities.

Comparison of a single European country with the U.S. was unfair, said Frydag, because the U.S. is virtually a continent. Only European cooperation in research and allocation of projects could be successful, he declared.

According to British government figures, Western Europe produced 12,000 engineering graduates yearly (Britain contributing 2,800), against the U.S. total of 22,000 in 1955 (50,000 in a 1950 peak) and the Soviet figure of 60,000 annually.

"In these figures," said Frydag, "I have not included China; but this country as well will have available, in some decades, a great number of engineering graduates." (The Chinese are already well advanced with a convincing supersonic fighter design, AMERICAN AVIATION learns from aviation engineers recently returned from Red China. The same sources said production plants were organized on modern lines.)

"The neutral visitor to the Farnborough Air Display is astounded to see the numerous fields covered by the British Aircraft Industry. Had Germany pursued such a varied development during the years after 1933, she would never have developed any substantial production," said Frydag.

Germans Concentrated Efforts

For World War II Germany planned two fighters, one night fighter, two bombers and only three large engines. So long as the program was rigidly followed the planned output was always achieved. Design was concentrated in seven airplane and three engine companies, with main production by specialized "state-financed, private-enterprise" plants. These latter were elaborately tooled for unskilled labor.

A film of World War II Me 210/410 manufacture at Henschel revealed a degree of automation far in advance of today: a plain I-type wing spar was put, as flat plates, and extruded sections, into a fixture with centralized hydraulic clamps in which it was completed by automatic drilling, reaming and riveting—only hand operation being insertion of rivets.

When the Luftwaffe failed to recover in 1941-42 the air supremacy the RAF had gained in the fall of 1940 and was by then pressing into Germany, military chiefs kept altering the program. This caused a fall in output below 2,000 monthly, until rigid concentration was resumed in March 1944—by September production had risen to 4,800 monthly.

Frydag said today's increased airplane complexity indicates an even greater need for concentration and rationalization. The United Kingdom should: consolidate its turbine transport lead; build two fighters, one interceptor, one supersonic long-range; build one supersonic bomber; co-operate with the U.S. and Europe by accepting responsibility for one class of missile.

British Aircraft Builders Study New Wing Design

A new type of wing designed by the Royal Aircraft Establishment is the basis of supersonic transport studies currently being made on British government instructions by seven companies in the United Kingdom. The companies are Vickers, Rolls-Royce, Handley Page, de Havilland, Short Bros. & Harland, A. V. Roe and Bristol.

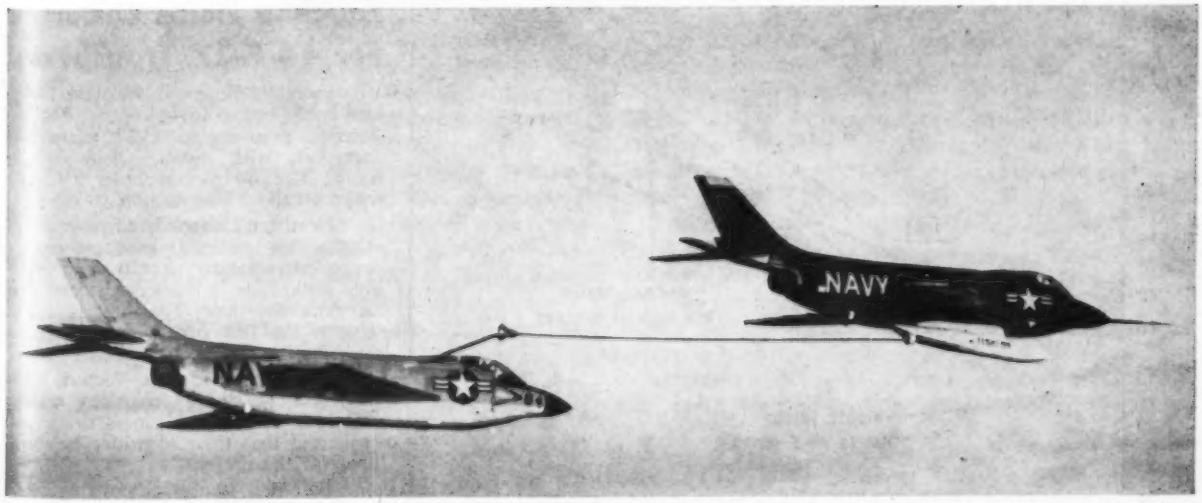
The RAE's "M" wing is a transonic device of the same species as area rule. The wing incorporates compound sweep, forward then back, using an angle to match the Mach cone so that the wing can gain from wave suction effects. Such a wing plan should also gain structurally where aeroelastic effects are involved.

It is thought that by combining the "M" wing with area rule it will be possible to reduce transonic drag so that cruising at Mach 1.2 (800 mph) will be possible without prohibitive power and fuel requirements.

Improved Terrier

The Navy confirmed that an improved version of its Terrier surface-to-air missile has been placed in production at Convair's Pomona plant. Original version was phased out in early November.

High-Speed Refueling for Navy Jet Fighters



A new probe-and-drogue jet-to-jet refueling system has been developed by Beech Aircraft Corp. under a research and design contract from McDonnell Aircraft Corp. Refueling system is carried in externally-mounted tank, consists of 50-ft. coil of flexible steel hose and hydraulic system to pump fuel at 200 gpm. Tank also can carry 300 gals. fuel, in addition to that carried internally by fighter-tanker. Here two McDonnell F3H-2N Demon Navy fighters demonstrate system.

Better Traffic Control, Communications Badly Needed in North Atlantic—ICAO

An urgent need for improvement in North Atlantic Region Air Traffic Control and Communications is seen by the International Civil Aviation Organization's "jet age task force." The seven-man panel was appointed by the ICAO Council to consider what improvements in air navigation services and facilities will be most necessary during the next five years.

The panel reports that "the world's outstanding case of immediate and compelling need for aviation improvement relates to air traffic control and communications in the North Atlantic Regions . . ."

"The enormous volume of air traffic is already suffering difficulties, delays and forced acceptance of undesirable conditions of operation which will grow worse with continuing expansion of air traffic until remedies for some of the fundamental causes of the present troubles are agreed upon and applied," the panel report said. "Without collective action by all the governments whose airlines fly the Atlantic, the development of North Atlantic air traffic will be more and more handicapped as the traffic continues to grow."

• **The panel,** headed by Dr. Edward P. Warner, found that the North Atlantic not only has by far the heaviest transoceanic traffic in the world, but one of the heaviest of all international routes. Year after year there have been consistently large increases in the number of civil flights over the region.

Analysis of transatlantic flights made during the summer of 1956 shows that more than half of these flights suffered substantial difficulties originating in communications or air traffic services.

Forty percent of the flights were unable to fly at the altitudes they had requested, or had to change their flight plans after departure because of air traffic control instructions, while 20% were delayed on the ground awaiting air traffic control clearance. One-quarter of the flights reporting on congestion of air-ground communications circuits experienced delays averaging 15 minutes because of this congestion; 15% of those flights reporting on air-ground communications failures due to radio propagation disturbances were unable to communicate with any ground station for periods of between one and two hours, and 6% more for periods of less than one hour.

Many Search, Rescue Alerts

Because of these communications failures, 44 search and rescue alerts on civil aircraft were declared in the Gander Control Area from June to August of 1956. The aircraft for whom these alerts were called were not in trouble, but a search and rescue alert is called after an aircraft has been unable to communicate with the air traffic control center for a certain length of time.

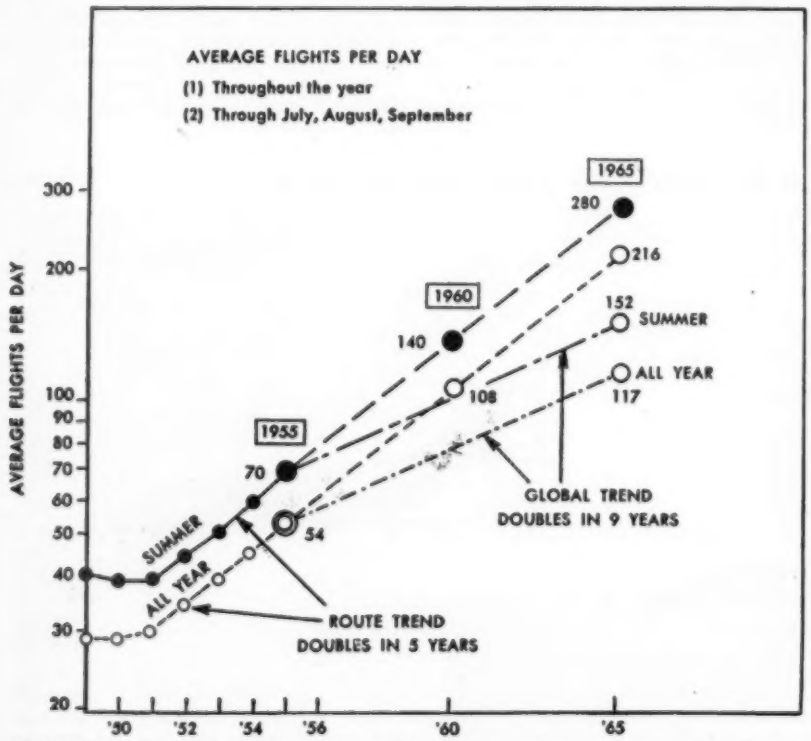
The panel made the following recommendations to improve the North Atlantic situation:

• **A technique** for point-to-point radio communications, called "VHF Forward Scatter," appears to hold much promise, as it is not subject to the blackouts that afflict the high frequencies now used . . . ICAO member states should consider the financial aspects of providing the system, including that of joint financing of the Iceland and Greenland stations . . . If technical evaluation supports the establishment of this circuit, everything possible should be done to have it operating by the summer of 1958.

(The Forward Scatter technique has been under development for the past few years. It operates on frequencies in the 30 to 60 megacycles/second band and depends upon the ability of the Ionosphere to scatter radiated energy of these frequencies so that a minute amount of this energy will reach distances of 1,000 miles or more).

• **As a matter of urgency,** tests should be pressed forward with a view to incorporating additional ground wave radio stations in the North Atlantic regional plan at locations where they will assist substantially in maintaining air-ground communications. (Ground wave communication, which is conducted on frequencies in the region of 3 mc/s from stations as close as possible to the edge of the sea, is not disrupted by the propagation disturbances which are present in the auroral zone.)

• **States concerned** should give every support to any Consol installation plan that results from action of the ICAO Air Navigation Commission. (Consol is a type of long-range radio beacon station used for position-fixing by aircraft in flight. Consol stations are in operation in Western Europe and in the United States, but gaps exist in the Consol chain across the North Atlantic.)



ICAO chart shows daily traffic on the North Atlantic northern route through 1955 with continuing trends into the future.

Fairchild Holds Orders For 44 F-27 Transports

Fairchild Engine & Airplane Corp. said it has orders for 44 of the Fokker-licensed four-engine F-27 turboprop transport, with options held on 29 more. The 44 planes have a dollar value of about $24 million.

Northern Consolidated Airlines, of Alaska, has ordered three passenger/cargo combination aircraft with movable bulkheads, a beefed-up floor and an extra-size door, Fairchild revealed. This is the first order received for a combination-type F-27.

Other new orders include five planes for a South American carrier and four for three business firms. All requested that their identities be withheld for the present.

Fairchild is also completing what it said will be "the most comprehensive cooperative advertising and sales promotion program ever arranged by an aircraft manufacturer for the airlines."

B52'S CIRCLE GLOBE NON-STOP IN

RIVERSIDE, Calif., Jan. 18—
Air Force Stratofortresses
day, a 45-hour 19-
around-the-
Lady II, on the first non-stop
flight around the world in 1949.
The three B-52's streaked over
the March base runway

...and AVIEN gages made sure they had the fuel to do it!

Around the world in 45 hours at altitudes of 5 to 10 miles! To America and the rest of the world this was history in the making... a dramatic demonstration of the ability of our Air Force to strike any target on earth.

And it was still another demonstration of the superior dependability of Avien Fuel Management Systems under the most rigorous service conditions. Standard equipment on the B52's... as well as in the IFR system of the KC97's that refueled them in flight ... the Avien fuel gages provided the mission's crews with assured control of fuel supplies throughout the 24,000-mile flight.

Wherever modern flight is thrusting toward new frontiers, Avien instrument systems are serving important jobs... providing the accuracy and reliability demanded by today's and tomorrow's aircraft.

Today Avien Fuel Gages, Engine Temperature Gages, and Fuel Flowmeters are in service on some 80 types of Air Force and Navy planes. Other Avien instruments will soon be operational on advanced aircraft now moving into production.

Whether for global bombers, Mach 2 fighters or missiles, the chances are that Avien's experience in designing and building precision instrument systems can help you meet the most critical requirements for control and measurement of fuel quantity, fuel flow or engine temperatures. Why not talk over your re-requirements with your Avien representative? Avien, Inc., 58-15 Northern Blvd., Woodside 77, N. Y.

Avien

PRECISION INSTRUMENTS AND CONTROL SYSTEMS
58-15 NORTHERN BOULEVARD
WOODSIDE 77, NEW YORK

Circle No. 16 on Reader Service Card.

What airline is giving all its planes radar "eyes"?

United Air Lines

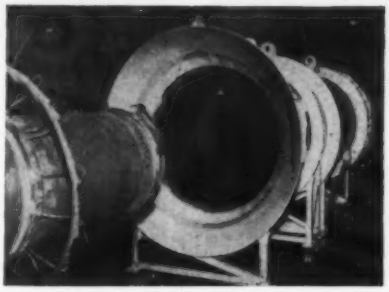
First U. S. airline to order radar for all its planes, United now has the world's largest radar fleet—and more coming. Radar lets your pilot "see" through cloudy skies 150 miles ahead, helps him pick the best and smoothest course. You experience new comfort and even greater on-time dependability at any time of year when you fly United. For reservations, call or write United Air Lines or an Authorized Travel Agent.

UNITED
AIR LINES

Southwest Airmotive Solves Jet Noise Problem

Jet engine test noise problem has been licked by Southwest Airmotive Co. at its Fort Worth facility, where J33 engines are tested after overhaul under Air Force and Navy contracts.

Two specially designed Industrial Acoustics mufflers have brought noise level considerably below 105-db count established as maximum in out-of-court settlement with home-owners in area. Installation of mufflers, 28 ft. by 8 ft., together with augmentor tube built by Southwest Airmotive, required only a 6 ft. extension to end of concrete cell building.



Augmentor tube moves on tracks.

Industrial Acoustics mufflers helped Southwest Airmotive silence jet noise.

Wages Moving Up in West Coast Plants

Wages are going up in west coast aircraft plants as a result of cost-of-living allowances and deferred increases negotiated in the present two-year contracts prevailing in the plants.

As a result of the Bureau of Labor Statistics' 118.0 index for last Dec. 15, hourly workers at Douglas Aircraft receive a 2¢ boost, added to the 4¢ they've been receiving from previous escalators.

Northrop Aircraft, which re-established a cost-of-living allowance effective with the Dec. 15 index, went up 6¢ in one jump. On top of this, Northrop announced a general wage increase of 7¢ an hour for hourly employes and 4% to 7% for salaried employes. The company said this was in accordance with its policy of maintaining wage levels in keeping with the rest of the industry. These increases are effective Feb. 18.

North American Aviation on Jan. 28 gave hourly workers a 2¢ cost-of-living increase, but this was based on the Nov. 15 index of 117.8 and, since the previous NAA allowance was 3¢ rather than 4¢ as at Douglas, it made the total 5¢.

AiResearch Mfg. Division of The Garrett Corp. raises both hourly and salaried employes by 4% on Feb. 11.

Cost-of-living allowance is included in United Automobile Workers' contracts at all NAA plants and Douglas-Long Beach and Douglas-Tulsa. In December, Douglas extended it to Santa Monica and El Segundo (International Association of Machinists). This union then sought allowances at Convair and Lockheed, but both refused, presumably because government contracts wouldn't permit increased labor costs.

Here's the picture on deferred wage increases that become effective:

- Lockheed: 7¢ an hour, effective Feb. 18. Georgia division is an exception to the two-year contract rule. Its IAM contract expires Mar. 31, and renewal proposals are being exchanged.
- Chance Vought: 6¢ on Mar. 12.
- Convair: 7¢ on Apr. 1 at San Diego and Pomona; Apr. 15 at Ft. Worth.
- Douglas: 7¢ on Mar. 18 at UAW plants, Apr. 1 at IAM plants.
- Rohr: 7¢ on Apr. 15.
- Boeing: 7¢ on May 22 at Seattle, July 23 at Wichita.
- Ryan: 7¢ on July 8.

Douglas Must Return Some '53 Profits to U.S.

Douglas Aircraft Co. disclosed that the regional Renegotiation Board had recommended that its fiscal 1953 profits be ruled excessive in the gross amount of $9 million, indicating a possible net refund to the government of $2,240,000, if upheld by the Renegotiation Board in Washington.

President Donald W. Douglas said he felt proper consideration of all the facts would show that the company had not earned excess profits. Net earnings in 1953 were $18.6 million on $874.5 million sales.

Meanwhile, Clyde Skeen, controller of Boeing Airplane Co., called for a Congressional review of administration of the Renegotiation Act. "If it is the intent of Congress to arbitrarily restrict profits, it can be accomplished much more simply than by the complicated, time-consuming and expensive process of renegotiation," he said.

The $10 million of alleged excess profits judged against his company in 1952 represented a penalty "right off the bat for having an advanced airplane designed and developed and the ability to expeditiously place it into production and deliver it," he added.

CAA Experts Visiting European Plants

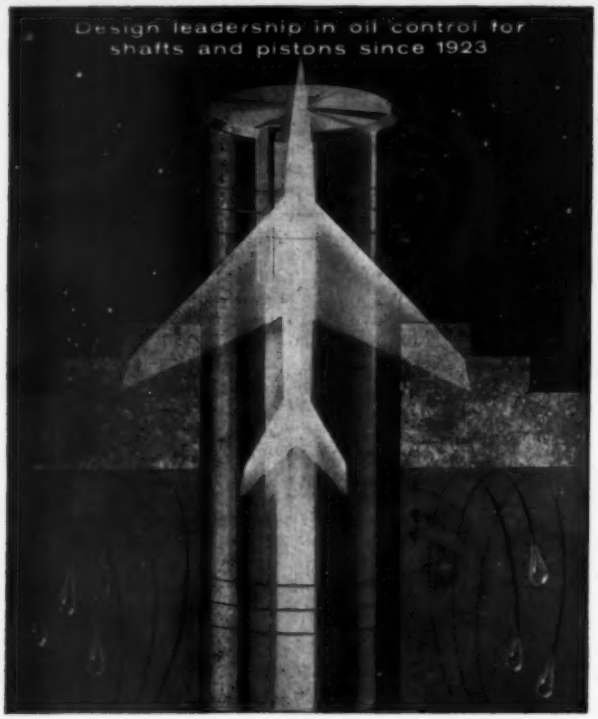
Certification of several European aircraft by the Civil Aeronautics Administration is being discussed in Europe by a CAA team which is making a familiarization and evaluation visit to several plants.

Among those in the group are Harold Hoekstra, chief project officer (transports); Raymond Maloy, chief of aircraft engineering—International; M. R. Disler, flight test; A. A. Goodier, powerplant; Byron Agee, air carrier maintenance, and William Krieger, air carrier operations.

Discussions are being held with the Air Registration Board in London on powerplant requirements with a view to establishing a list of differences between British and U.S. practice.

Visits are being made to several British plants to hold type certification board meetings on the following aircraft: Vickers Viscount 810/840, Handley-Page Herald, Scottish Aviation Twin Pioneer and Aviation Traders Accountant. Talks also are being held with Bristol Aircraft on the Britannias ordered by Northeast Airlines and with de Havilland on the Comets ordered by Capital Airlines.

The CAA team was also scheduled to visit the Netherlands to talk with the Dutch civil aviation office and with Fokker Aircraft on the F-27 certification program. The group will also go to France, where a visit will be paid to Sud-Est Aviation's plant in Toulouse for talks on the Caravelle. The CAA group is expected to complete its visits by about February 23.



HIGH SPEED shaft sealing problems?

...solve them with SIMPLEX

Shaft speeds to 20,000 rpm and higher present special problems in shaft seal design — especially when high temperatures or other special conditions may also be involved.

To designers and builders of jet or reciprocating engines and auxiliaries, SIMPLEX offers exclusive design principles and extended industry experience in solving similar problems. SIMPLEX products are original equipment in Allison, Pratt & Whitney, Wright and other leading aircraft engines.

Whether your oil control problems involve shaft seals or piston rings, SIMPLEX engineers will be glad to help you work them out. Call, wire or write.

Simplex Piston Ring Mfg. Co.
12301 BENNINGTON AVENUE • CLEVELAND 11, OHIO
75 N. E. 74th STREET • MIAMI 38, FLORIDA

SIMPLEX
HIGH SPEED SHAFT SEALS AND PISTON RINGS

Circle No. 37 on Reader Service Card.

Globemaster at South Pole

Largest aircraft ever to land at South Pole is the Douglas C-124 Globemaster of the 52nd Troop Carrier Command from Donaldson AFB, S. C. Big planes are air-dropping 580 tons of supplies to prepare a base for Navy scientific survey team. Top photo shows Globemaster over Beardmore Glacier, world's largest and the traditional route to geographical South Pole. Other pictures are at Polar base.

M-H Tackles Inertial Component Challenge

Aeronautical division lays plans for mass-production of super-accurate gyros and accelerometers; laboratory standards hard to reproduce.

By HENRY P. STEIER

"Our role in this industry is to put new ideas to work as practical ideas with reproducibility."

That's how Jack W. Lower, chief of gyro design at Minneapolis-Honeywell's Aeronautical Division, summarized his company's history-making technical effort to meet one of aviation's most challenging demands.

The demand is for guidance accuracy. Despite the speed and range performance of aircraft and missile weapons systems, guidance accuracy is the key element in their final punch.

• **Guidance systems** that "know where they are because they know where they have been" are known as self-contained systems. The inertial type seems destined to occupy the mainstay position among guidance systems of the future.

Emergence of inertial guidance out of the laboratory into a top-bracket role in operational weapons systems has thrown the production "ball" to industry.

M-H's aim is to mass produce the gyroscope and accelerometer components for these inertial systems despite their previous laboratory nature.

Needed: Revolutionary Approach

The role M-H has selected for itself means a revolutionary production approach must be found to produce the components whose precision was until very recently discussed only in terms of laboratory samples operating under laboratory conditions.

One of these devices is the hermetically sealed integrating gyroscope (HIG). It is one of two types finding use in guidance systems. The other type is the displacement gyro.

Similar to conventional gyro-compass and artificial horizon gyro types already in common use, the displacement gyro in an inertial system would, however, require much-improved sensitivity in determining and accuracy in maintaining its spin-axis position in space despite movements of the carrying vehicle.

• **Three limitations**—bearing friction, ruggedness and damping—handicap conventional gyro operation. In 1946, Dr. C. S. Draper, who heads MIT's Instrumentation Laboratory, took up the idea of floating a gyro's gimbal in a viscous fluid to ease the operational problems.

Under an Air Force contract, Draper built some floated gyros to investigate his theories. In 1948 industry was invited to produce floated gyros. Honeywell accepted the challenge, rejected by most of the companies, to produce the HIG and has been at it since, but not without continuous plowing of fresh ground in the field of production engineering.

First big decision was to decide if reliance was to be placed on factory workers and the machines they use or to "boot-strap" the production shop into an instrument laboratory.

• **The answer** in a competitive market, it was felt, was to split the work among factory workers and train each on a very small part of the operation and give each a chance to acquire skill in that small part.

To aid the workers in accomplishing their roles as production line instrument makers, heavy reliance was put on the provision of testing equipment of a whole new order of accuracy.

Much of the equipment in use by M-H today puts a strain on calibration standards provided by the U.S. Bureau of Standards against which many of the instruments are checked periodically.

New instruments have been pioneered by M-H in its HIG work, and the company has helped start new companies to produce parts needed in the HIGs.

• **M-H floated gyros** have been in production since 1951. Now the demand is for smaller and more accurate HIGs. Latest of these is the HIG-6 and MIG (miniature integrating gyro) gyros for inertial platforms that will perhaps end up in ICBM and other missiles as well as piloted aircraft on the boards.

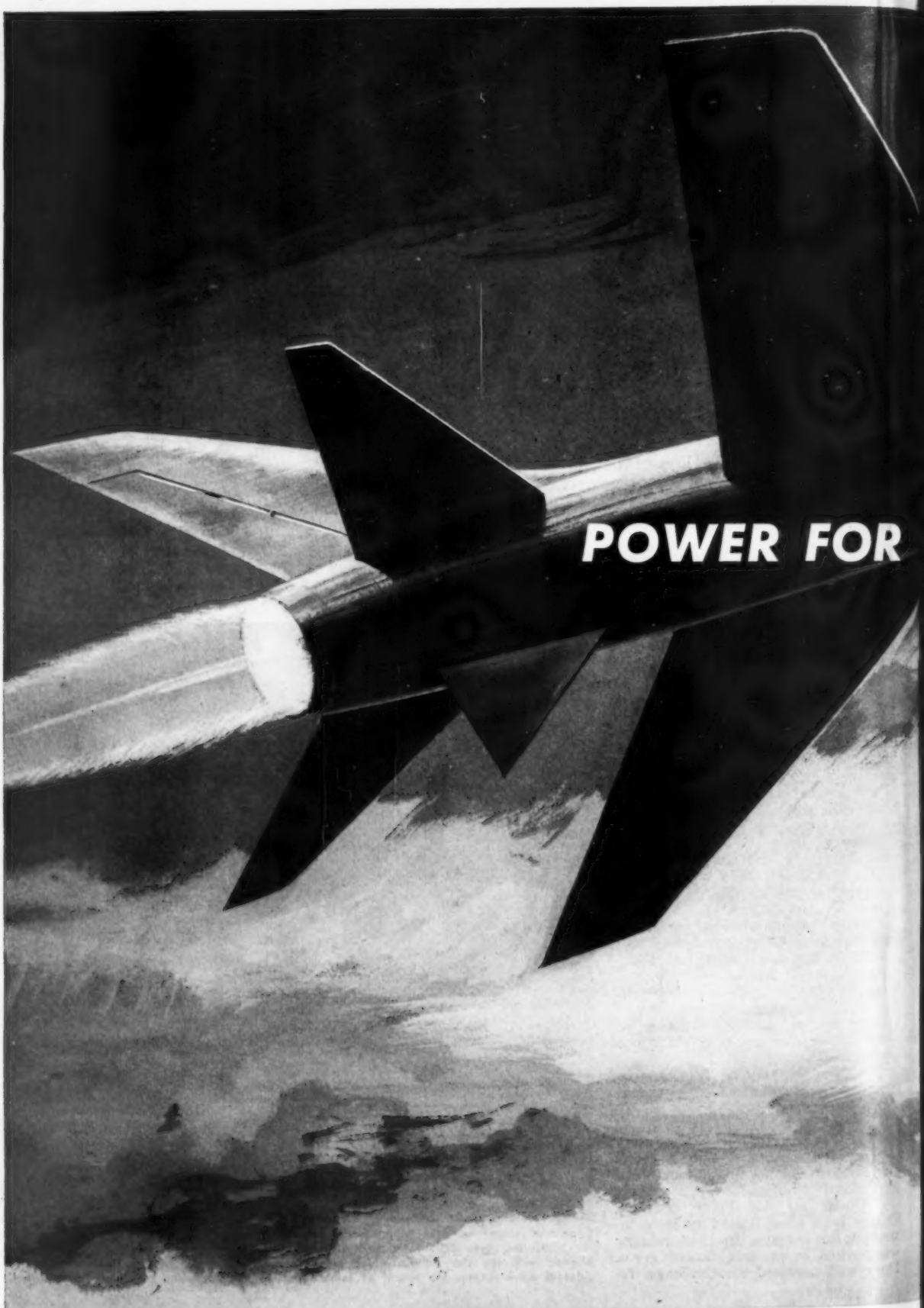
According to M-H engineers the size of an inertial platform goes up as the cube of the gyro size. The new MIG weighs 0.48 pounds compared to 3 pounds for the HIG-5 and measures 1.75 x 2.5 inches compared to the other gyro's 2.75 x 6 inches.

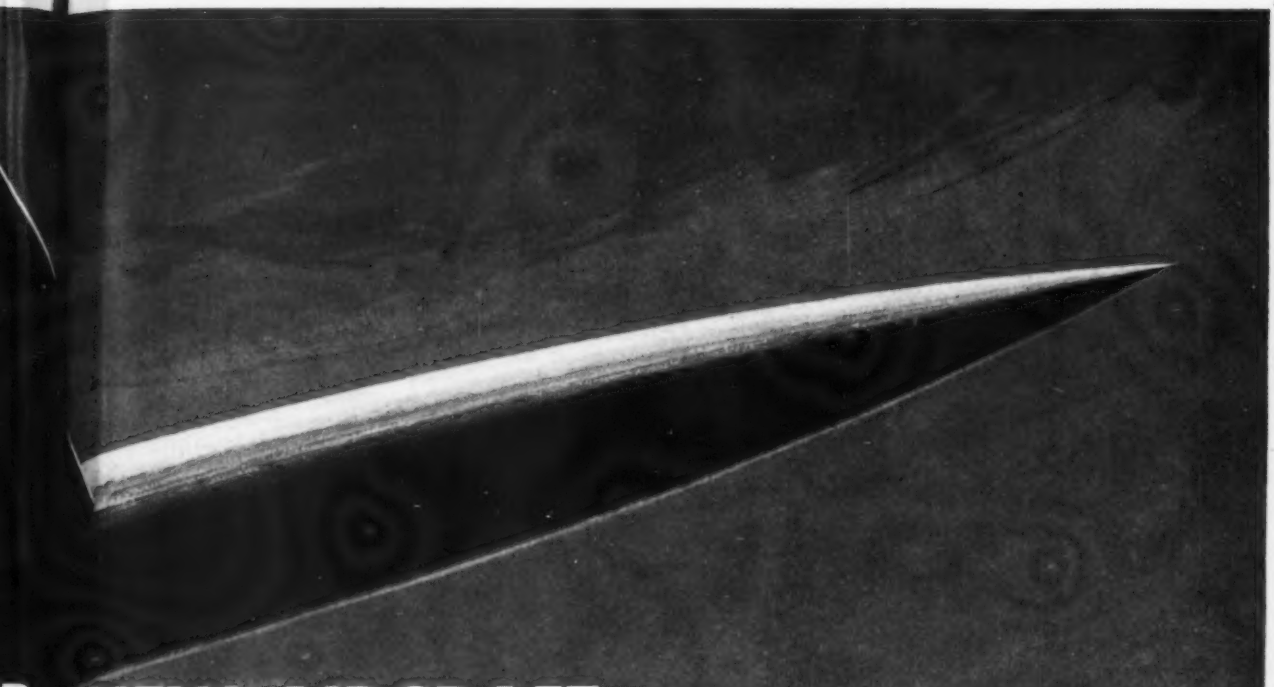
Started for Douglas

Development of the MIG was started for Douglas Aircraft Co. and its Navy Instrumentation program. Later

(Continued on Page 56)

Equatorial mount used in Minneapolis-Honeywell's laboratory as a neutral motion testbed for measuring gyro drift rates and evaluating inertial guidance systems. Axis of mount is aligned with the star Polaris, which means axis of mount is parallel to axis of earth. A sidereal drive rotates the mount at same speed as earth rotation but in opposite direction.


POWER FOR



NEW AIRCRAFT—
IN WHATEVER FORM IT TAKES

The pioneering vision and sound engineering which led from the Wasp to the widely-used J-57 are today leading Pratt & Whitney Aircraft into activities which may influence the whole future of aviation.

For example, the most powerful U. S. production turbojet, the J-75, again shows Pratt & Whitney Aircraft's ability to develop the right kind of aircraft engine at the right time. The J-75 has been selected for the newest Air Force fighters, the Navy's most advanced long-range patrol bomber, and both the Douglas DC-8 and the Boeing 707 jet airliners.

This success may be largely attributed to engineering skills and achievements. Since the beginning of the company, when the new Wasp produced the most horsepower per pound of weight, there has been no change in the reliance on these fundamentals . . . except that new talents and techniques, elaborate research facilities, and many new kinds of engineers are called for at a growing rate. At Pratt & Whitney Aircraft, nearly every field of theoretical and applied science—from nuclear physics and chemical engineering to advanced metallurgy and electronics—has a vital part to play as the science of aircraft propulsion advances.

Today, power plants of the future are being developed by Pratt & Whitney Aircraft. The Connecticut Aircraft Nuclear Engine Laboratory, for instance, will be operated by Pratt & Whitney Aircraft for the AEC and the Air Force. Whatever form the future takes . . . in new principles of propulsion, new materials or new fuels . . . Pratt & Whitney Aircraft is prepared to offer continued advancement in power plant design and production.

Pratt & Whitney Aircraft

MAIN OFFICE AND PLANT: EAST HARTFORD, CONNECTICUT • BRANCH PLANTS: NORTH HAVEN, SOUTHINGTON, MERIDEN

In Canada: Canadian Pratt & Whitney Aircraft Co., Ltd.

FIVE IMMEDIATE OPENINGS FOR DESIGN ENGINEERS

★

Armament Design Engineer. To design, install and test gun, rocket and missile systems. Requires degree in Engineering and either one year armament installation design experience, or three years general design experience.

★

Senior Surfaces Design Engineer. To create production design of wing, tail and control surfaces for missiles and fighter aircraft. Engineering degree and four years design experience.

★

Senior Hydraulics Designer. For development, detail design and test work on complex hydraulic power control systems. Engineering degree and at least four years experience in hydraulic design.

★

Support Equipment Engineer. For a wide range of development assignments including complete airborne photo systems and submarine handling equipment for guided missiles. Engineering degree and at least three years design experience.

★

Designer for Pilot Escape System. Requires Engineering degree and at least three years work with pilot escape mechanisms, plus other related practical design experience.

To arrange for a personal interview, or for a prompt, confidential report on these openings, write to:

Mr. J. W. Larson, Asst. Chief Engineer
Dept. AA-1

CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

(Continued from Page 53)

the gyro program was expanded for Jet Propulsion Laboratory and its major missile program.

JPL has been closely related to Army missile work. Use of the MIG in missiles is expected to be for short-term inertial guidance.

A numerical suffix is used with most M-H gyros and refers to the angular momentum of the flywheel. In the case of the MIG this is 10^5 gram-centimeter^2—a lower value than previous M-H gyros.

• **Drift rate** of a gyro is an important factor in determining its accuracy and sensitivity. An obvious method of cutting drift rate is to increase the angular momentum of the flywheel.

Despite the small wheel size of the MIG, its drift rate performance is comparable to the larger HIGs in rugged environments. The rate is about 0.5 degrees per hour.

Some idea of what this kind of accuracy means can be taken from the HIG-6 rate, which is 0.1 degree per hour. If the HIG-6 were rotated at such a rate that it would turn completely once in five years, the gyro would make a correction for its displacement.

Flotation fluid in the MIG and HIG-6 gyros reduces gimbal bearing load to such a low point that starting friction—"stiction"—permits a very low input signal threshold.

There are other random torques applied to gyro gimbals which act as serious detriments to accuracy. Besides the built-in friction, there is the dimensional stability problem under temperature variation and shock, electromagnetic non-linearities and asymetries, and vibration torques due to elasticity of materials in one direction—called ainsoelastic properties.

• **The new MIG** is expected to give M-H's factory production line concept a severe new test. Successful manufacture of the MIG may change the term "fitted like a watch" to "fitted like a MIG."

For example, the gimbal bearings in the new gyro are jewels that support 0.018-diameter pinions whose diameters are controlled to 20-millionths of an inch. Watch jewels available to fit such pinions just do not fill the bill.

M-H is considering production of sapphire jewels for bearings as well as precision ball bearings that support the flywheel. Batelle Memorial Institute is helping M-H design an optical system for measuring the jewels.

Diameter of the stator in which the flywheel rotates is held to 0.0003 inch without grinding. Grinding would destroy the magnetic character of the stator materials.

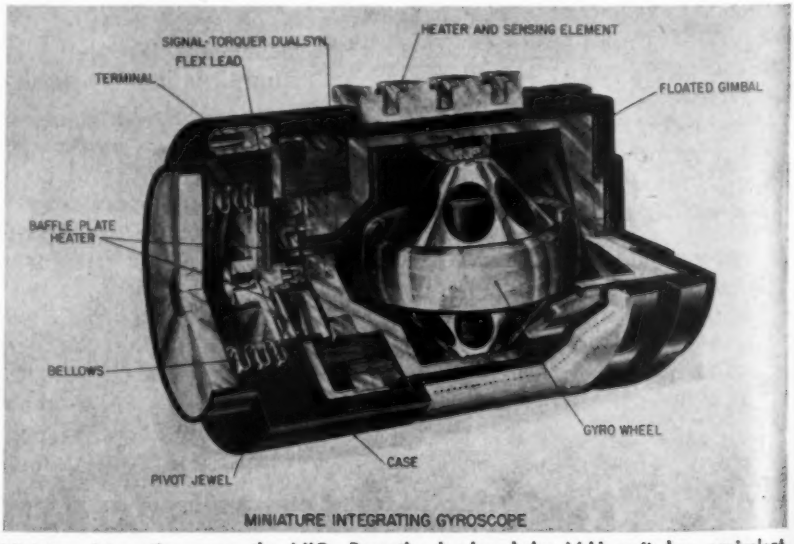
• **Fitting together** the MIG is done by factory labor whose experience permits them to "feel" end play in some assemblies within 0.0005 inch. Some of the other fitting processes used in the new MIG hold the answer to the MIG's unique success and will not be discussed by the company.

Another typical operation is measurement of helium leakage out of the gimbal housing. The flywheel rotates in this housing in an atmosphere of helium.

• **Leakage of helium** into the Fluorlube flotation liquid that surrounds the gimbal housing would create random torques affecting accuracy. Random landing of a bubble of helium on the gimbal housing or its bearings would introduce a random torque due to unbalance. Reliability of gyro accuracy would be affected.

Leak detectors capable of measuring a leak rate of one cubic centimeter per 30 years are in use in the assembly rooms. These are mass spectrometer detectors. One developed by M-H can measure a leak rate of one cubic centimeter per 3,000 years.

Another problem is keeping air or



Miniature integrating gyro—the MIG. Recently developed by M-H, unit has equivalent characteristics to larger gyros yet is about one-third the size and one-tenth the weight. It is expected to find wide use in short-term inertial guidance of missiles.

A Vought Vignette

FIRST IN A NEW SERIES

The Aircraft Designer Who Went to Sea . . .

IT WAS A ROUTINE CRUISE for the *Bon Homme Richard*. But for Wayne Burch, it was a memorable climax to months of hard work. Aboard the carrier with the Chance Vought design specialist was the white-lacquered fighter he'd worked on so long.

★

Wayne had joined the Crusader dayfighter project in Preliminary Design, on alighting and arresting gear. He'd transposed his initial drawings into detail design and, later, he'd watched his gear pass jig and aircraft drop tests. At the Navy Test Center, the Crusader's gear absorbed maximum sink speeds and arresting tension, and Burch once more was there.

★

Now, Navy pilots on the *Bon Homme Richard* were taking the Crusader to sea, and Burch was going along. This time his assignment was simply to watch, and this time the Crusader was to be just part of the picture. Vought wanted him to experience carrier life and to see how his new weapon fitted in. For Wayne, whose sea log began and ended with one day's fishing from a 20-foot launch, it promised to be an eye-opening voyage.

For six days the designer shared quarters with Navy fighter pilots and had coffee with maintenance men. He studied aircraft spotting and catapulting, and he learned the sign language of the LSO (Landing Signal Officer). He marveled at the fingersnap timing of the Navy's deck handlers and at the *Bon Homme Richard's* mid-voyage refueling of two bobbing destroyers.

★

Wayne calls it "one of the most enjoyable weeks of my life" . . . and, as other sea-going Vought engineers have discovered, "one of the most profitable, too.

"Now I know the pilot's job, what maintenance wants . . . how really big the operation is.

"It's something you don't get if you stick too close to design.

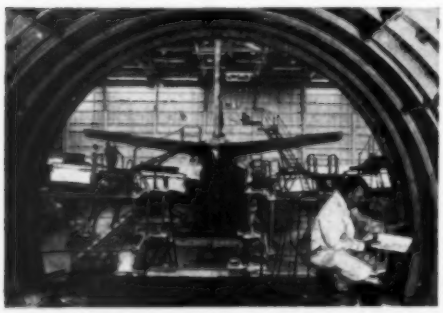
"I guess you'd call it *perspective*."

At Chance Vought the designer stays in touch with his product . . . Contact begins in development, extends through test and includes, when possible, a study by the designer of the tactical environment in which his weapon will serve.

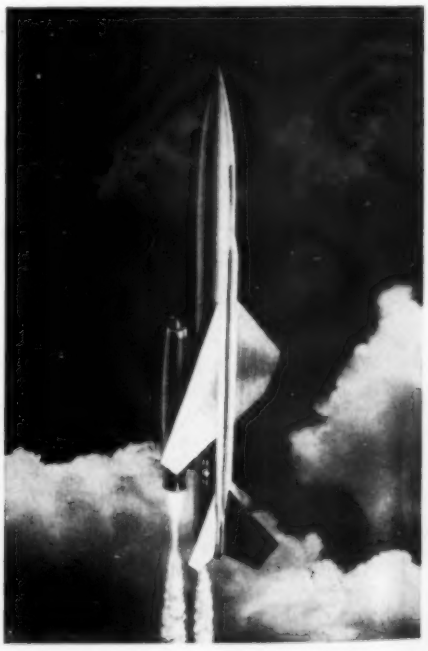
CHANCE VOUGHT AIRCRAFT
INCORPORATED · DALLAS, TEXAS

BULLETIN FROM **BOEING**

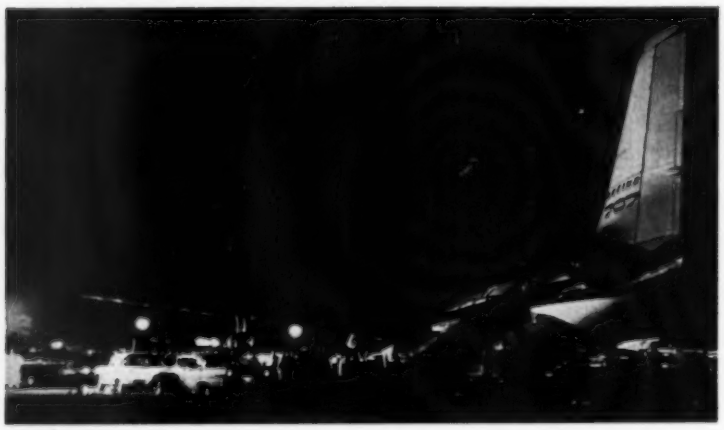
AMERICA'S RETALIATORY "REACH" was demonstrated when a Boeing B-52, refueled in flight, recently covered 16,000 miles, non-stop, in 31½ hours. The B-52, along with other Boeing Stratofortresses, wheeled over the North Pole, and circled the perimeter of most of Canada and the United States. Fully loaded for simulated bombing runs, the Boeing B-52s flew at speeds up to 650 mph, and at altitudes up to 50,000 feet.



WINGED REFUELING STATIONS, jet-powered KC-135s, are moving off Boeing production lines on schedule. In service, KC-135s will add thousands of miles of reach to jet-powered bombers and fighters, refueling them at speeds and altitudes best suited to jet operations.



BOMARC. Boeing's Pilotless Aircraft Division is conducting successful firing tests of supersonic defense missiles. Boeing's BOMARC guided missile assignment includes development of electronic guidance, launching means, bases, supplies and maintenance.



AMERICA'S ONLY JET TRANSPORT, the Boeing 707, parks at Los Angeles airport after flying Civil Aeronautics Board officials down from Seattle. Return flight carried International Air Transport technicians, reached Seattle in 1 hour 50 minutes. The 707 is helping officials work out procedures and rules for commercial jet flight in the U. S.

BOEING

AMERICAN AVIATION

any other gas out of the space into which the Fluorlube liquid is inserted. Filling is done under laboratory-type vacuum bell jars.

The gyros are baked-out to remove gases. The Fluorlube is a solid until heated. In operation the floated gyros are heated by built-in resistance elements.

Heated Fluorlube is inserted into each gyro under vacuum conditions. The filling process takes 10 hours per gyro. Forty hours of vacuum baking is required per gyro.

Time-Consuming Process

Every operation takes a lot of time. The MIG must be assembled and disassembled many times during its construction. The HIG-5 requires four major matching operations during construction.

Rotor and stator must be checked for signal output. Weights must be added or taken off the gimbal-flywheel assembly for balancing. Pinion and jewel bearings must be matched. Bearing loading must be checked by testing characteristics of the spin motor. All this is done without benefit of the Fluorlube filling to absorb shock during handling.

The tiny tungsten carbide pivots in their jewel mountings are supporting the relatively heavy weight of the gimbal assembly. The slightest shock and pinions or jewels would be destroyed.

When it comes to final testing, another round of long-time factors enters the picture. Some typical test times for various gyros are:

HIG-4—14 hours
HIG-5—7 hours
HIG-6—24 hours
GG37—24 hours

The GG37 gyro is a new unit now in production. Known also as the ISIP (Inertial System Indicating Position) gyro, it has a drift rate of 0.01 degree per hour. It is expected to become the inertial gyro "workhorse" for long-term guidance platforms. Size of this unit is 3.3 inches in diameter by 4.6 inches long.

Finding a place and machines for testing such sensitive devices is a major production problem. For correct testing, a stable platform which has *no* movement is ideal.

Deflections of a concrete and steel floor, caused by a man's weight shifts as he walks, can throw the tests off. Some of the units are tested only during evening hours when there are fewer people about.

Under a perfectly null condition of movement a perfect gyro would give no output. In ordinary testing the earth's rate of movement must be cancelled out of test results.

'Forcing' Production

M. Edward Carlson, a M-H section chief in gyro production engineering, said "you don't put—you force—such devices into production." Today, the pressure behind that force is stronger than ever.

Left: technician testing a floated gyro gimbal for helium leakage. A mass spectrometer records leakages as small as 1cc per 30 years. Right: evacuated bell jars containing HIG-5 gyros are used to permit filling of gyro case with Fluorlube fluid that gives floated gyros exceptional damping and low friction level characteristics.

At one time 7-10 years research to production time was the norm. Today aircraft and missile work has shortened that time.

What is needed is often not known until the day before the unit flies. True systems engineering is not an accomplished fact in the airframe business, according to M-H engineers. Not until it flies are the gyro needs known.

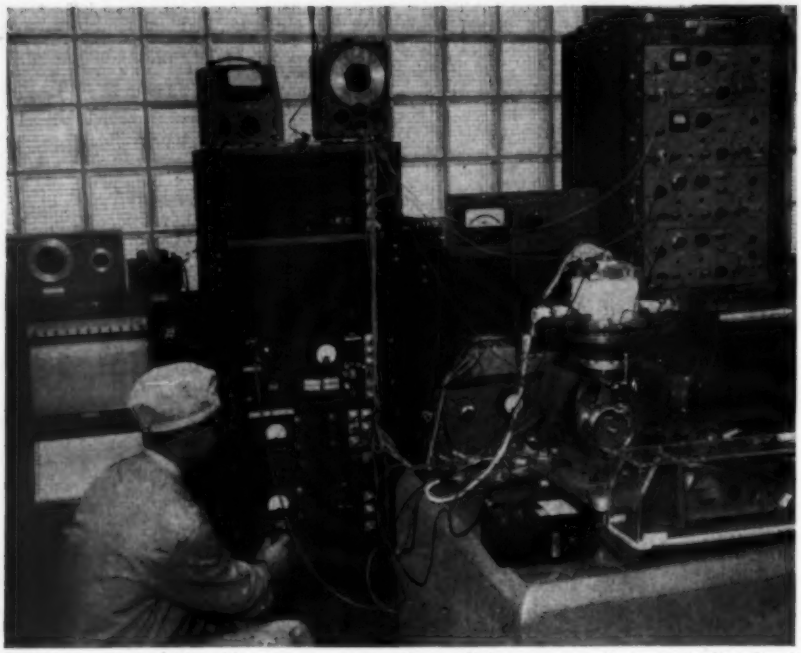
Many aircraft of advanced design are so unstable that they cannot fly without the gyros. But, with a missile, the trouble can be even worse. It must come together at one time as a workable device. One change affects too many other factors to permit modifications of any nature, even in the gyros.

M-H's production engineering group feels the answer to shortened time between research and production is production research. They must anticipate the problems rather than cope with them.

New instruments must be pioneered to take care of future prospects. Part of this work is considered to be "wakening up" of existing companies to future needs. Part of it will be sponsorship of new instrument manufacturing organizations.

One thing M-H insists it will

Final calibration of HIG-4 gyros is done by production technicians. Drift rate and other tests take eight or more hours. On HIG-6, a long-term inertial platform gyro, test takes 24 hours. Super-precise laboratory standard meter in left foreground is not good enough for latest precision gyro tests. Supply of new instruments poses big production headache.



Drift rates of inertial guidance gyroscopes of new design are tested on a dividing head mounted on a concrete pillar. Sunk many feet into ground onto bedrock and not connected with the building, the pillar platform is further attempt to isolate extraneous vibrations from the gyro—a problem that becomes more difficult to solve as newer, more precise units are developed.

not do is use laboratory setups to produce its gyros. Neither, it says, is it practical to send a Ph.D. along with each gyro unit.

If this were feasible, the problem of reproducibility of specification and characteristics of gyros would not matter. Each could be treated as an individual unit by the Ph.D.

Repeatability and reproducibility of gyro characteristics is the only answer. It can be solved by production methods and machines, and by the negotiation of reasonable specifications.

These are needed since differences must appear, no matter how slight, between production units. A case in point, one engineer said, is Dr. Draper's comment to M-H that the HIG-4 is "ten times better than you say it is."

Producing 300 A Month

Production of the HIG-5 is now 300 a month. Since 1951 about 21,000 have been made. At this time the HIG-6 is being made at the rate of 25 a month. Customer cost is about $4800 per gyro.

To date only five ISIP units have been produced and the MIG schedule calls for two a month. Cost of the MIG, despite its production problems, is expected to be around $4500 and the ISIP about $3500.

M-H's production research engineers are looking to future problems that will make current ones look easy. Drift rates reduced by many more decimal places are in prospect.

Bearingless gyros using electrostatic suspension and perhaps gyros with spinning electrons is part of the "blue-sky" outlook in this field. How measurements can be made on such devices with sensitivity factors many times those of present units is what M-H's researchers are hunting.

Perhaps a platform in outer space may be the only practical platform where such units can be tested without interference from earth-produced and man-made vibrations and movements. ◈◈◈

Airlines Restudy Anti-Collision Devices

Airline progress toward development of a suitable anti-collision device, stymied temporarily by Collins Radio Co.'s cancellation of its system development commitments, has gained new headway. Carriers have mapped plans for an alternate set of requirements.

Airline technical and operational specialists, headed by a nucleus of Air Transport Assn. electronics engineers, held their first meeting to arrive at the new ground rules, reportedly including a cooperative-type system, to be submitted to all ATA members for approval.

Previously, the carriers had ruled out the cooperative-type anti-collision device in favor of the "self-sufficient" system such as proposed by Collins.

Presumably ATA plans to retrace its steps and ask manufacturers to propose their approach to meeting the new requirements once they are approved by all carriers. This approval, ATA estimates, should be processed within a matter of weeks so that the new plan can be made public within the next month.

At least one major producer has gone on record as believing that the airline's two-phase search for an airborne anti-collision device will prove fruitless. The firm, Hughes Aircraft Co., made public a report of its conclusion that the program viewed by ATA will be technically and operationally unsatisfactory.

As a result, the report states, continued work at Hughes will be conducted on the basis that the answer to the anti-collision problem lies within the framework of air traffic control.

New Loran Receiver for Civil Transports

A new Loran receiver, said to be the first designed for civil transport aircraft, has been produced by Edo Corp. The receiver uses an oscilloscope display unit designed for cockpit installation.

Installed weight is 26 lbs., as compared with the 39-lb. APN-9 military system now in use in planes of some international carriers.

The receiver portion, a ¾ ATR rack-mounting unit, has four crystal-controlled channels operating at frequencies of 1,750, 1,850, 1,900 and 1,950 kilocycles. A wide-band superheterodyne circuit is used.

Signal drift due to irregularities of pulse repetition is said to have been eliminated by automatic control of the receiver reference oscillator.

A panel control unit and the 3-in. scope can be panel-mounted. Power requirement is about 175 watts at 115 volts, 400 cycles, single phase, and 2.5 watts at 24 volts dc.

Edo Corp. Model 345 airborne Loran receiver, control panel and indicating scope.

Boundary Layer Control Has Proved Worth, NACA Report Says

Sufficient work has been done in the field of boundary layer control to merit its introduction to the designs of future military and civil aircraft.

This was a conclusion advanced by the National Advisory Committee for Aeronautics in its 42nd annual report. Basic research on BLC for high-lift purposes has been "essentially completed" and it is now possible to estimate with fair accuracy the gains to be realized in lift, the cost in power required and other BLC possibilities NACA said.

"Information now in hand strengthens the belief that further effort to utilize boundary-layer control in future designs will be repaid by substantial performance improvement," NACA said. It said further studies are under way to determine the possibilities of BLC for drag reduction in high-speed flight and in the internal operation of gas turbine engines.

• **The report** describes a number of NACA projects employing boundary layer control on North American F-86, FJ-3 and F-100 aircraft. It noted that the GCA approach speed of an F-86 was lopped from 140 to 115 knots through the use of BLC.

"Perhaps the most interesting, though as yet tentative, conclusion drawn from the flight-test results is that boundary-layer control is tending to remove lift as a limiting factor in choosing a minimum flight speed," NACA said.

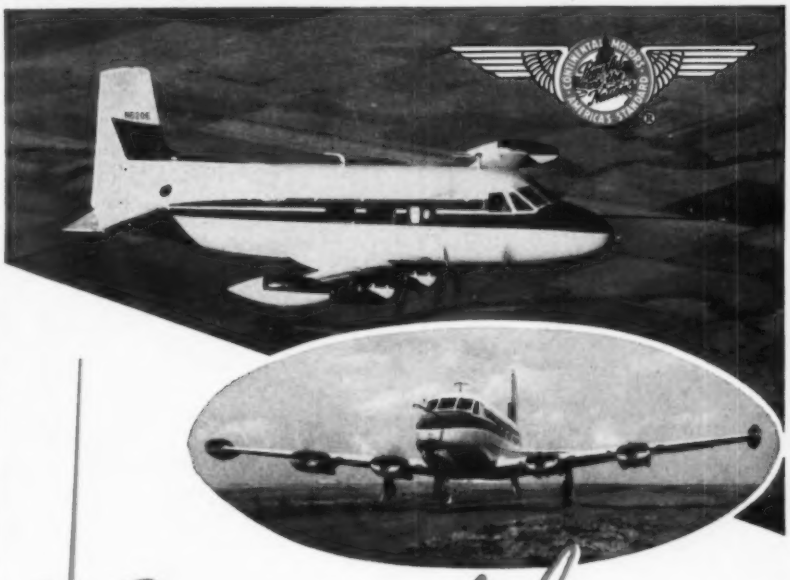
In place of lift, pilots tend to select as their minimum speed choice the minimum rpm at which their turbines can operate and still respond effectively to demands for increased thrust, it said.

The NACA report also contains a fairly complete historical summary of the experimental high-speed research aircraft program in which NACA has participated with the Air Force and Navy. It discusses the committee's contributions to the early structural difficulties of the Northrop F-89, the "inertia coupling" problem encountered by the F-100 and the application of the area rule principle to the Convair F-102A.

Other sections describe NACA's current work in aerodynamics, powerplants, propellers, hydrodynamics, fuels and the like. It also discusses the types of metallic fuels and slurries tested for possible use in ramjet engines.

Beckman to Expand

Beckman Instrument Inc. is negotiating to acquire four or five other companies. Dr. Arnold O. Beckman, president, said current plans are to form a completely integrated company covering the entire instrument field.



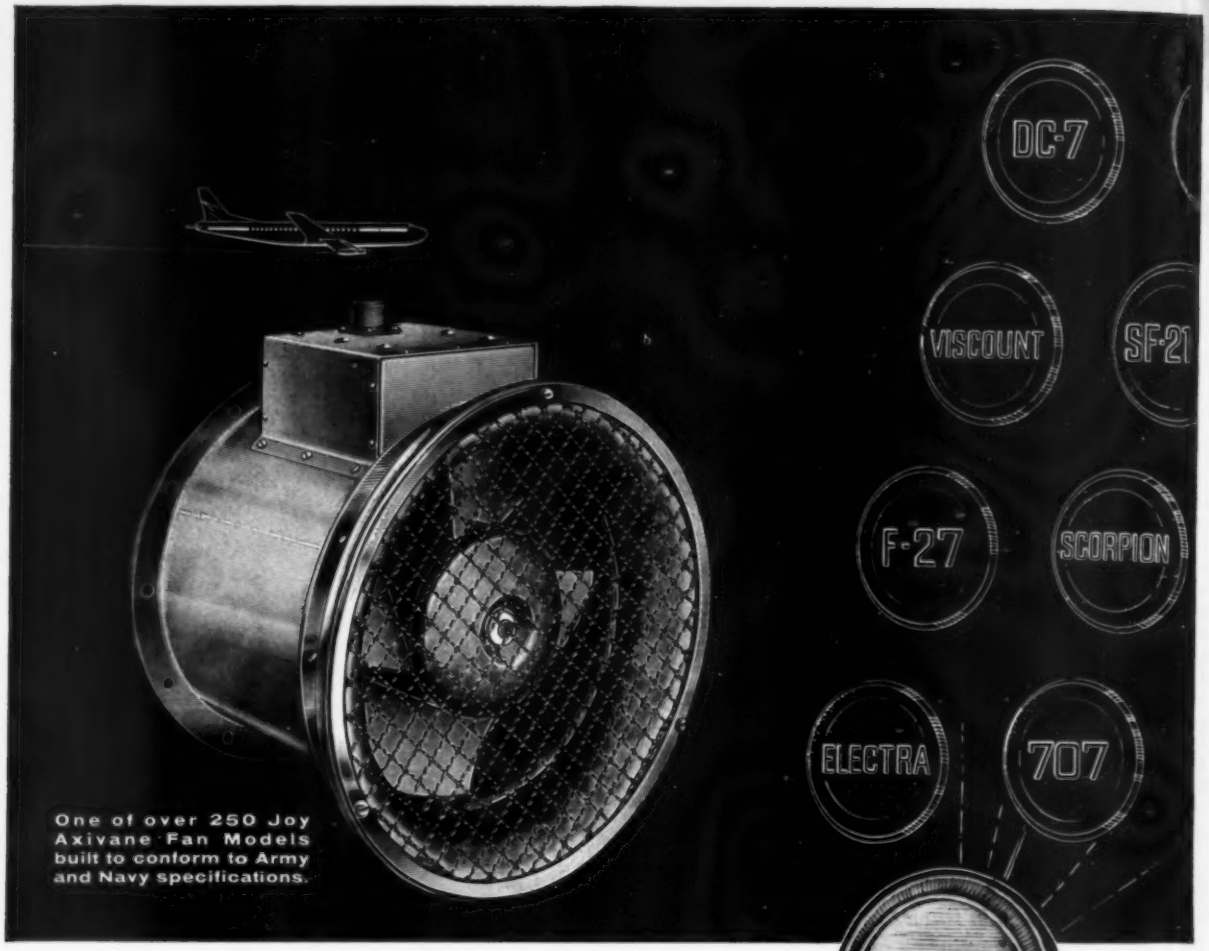
Continental Shares in Another "Aviation First"

. . . CESSNA MODEL 620, WORLD'S PIONEER PRESSURIZED FOUR-ENGINE EXECUTIVE TRANSPORT

Two organizations long noted for their contributions to flying have joined hands to achieve another major aviation "first," Cessna's Model 620, now flying. . . . The Cessna Model 620, world pioneer of its type—first pressurized four-engine airplane built for the corporate market—unites several qualities which users of executive aircraft have long desired. Its four Continental Red Seal GSO526-A engines provide four-engine safety, with the important plus of Continental dependability, economy and service backing. It is pressurized for altitudes up to its four-engine service ceiling of 27,500 feet, and air-conditioned for comfort aloft and on the ground. . . . Flights climaxing three years' work on this advanced airplane have fully borne out its builders' highest expectations. The Cessna 620 now takes its place as the latest on the long roster of fine utility aircraft using dependable Continental power.

Continental Motors Corporation
AIRCRAFT ENGINE DIVISION
MUSKEGON • MICHIGAN

Circle No. 17 on Reader Service Card.



Joy Fan **EARNS ANOTHER MERIT BADGE**

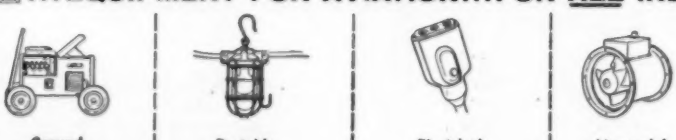
IF WE WERE STILL SCOUTS we couldn't be happier with Douglas' selection of Joy *Axivane* Fans for the DC-8. Douglas must be pleased, too, because this is a repeat order . . . Joy fans were used on their DC-6 and DC-7.

JOY'S IN-LINE DESIGN permits fan installation right *in-the-duct* for real space-saving. Light-alloy construction cuts weight but gives much greater strength.

WE'RE STILL BUCKING FOR "MERIT BADGES" and if you have an aviation or electronic ventilation problem, give us a call. *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 140-8-A

JOY...EQUIPMENT FOR AVIATION...FOR ALL INDUSTRY



Ground Power Units | Portable Lighting | Electrical Connectors | Vaneaxial Fans

WSW A 6370-140

Circle No. 18 on Reader Service Card.

New Products and Processes

BARBER-COLMAN ACTUATORS AND VALVES

Four new products have been introduced by Barber-Colman Co.: two actuators and two valves.

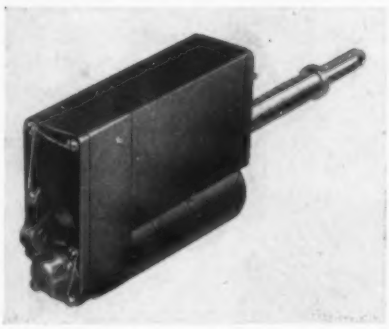
A lightweight SYLC linear actuator is designed for 150-lb. operating loads and 20Gs vibration. The other actuator is an electromechanical rotary type.

With the linear actuator, integral, non-jamming positive stops maintain a fixed relationship to externally adjustable travel limit switches. Maximum stroke is 3½″, weight 1.86 lbs. Radio noise filtering to Specs. MIL-I-618 lb and thermal overload protection are available.

The rotary actuator moves a 7.5-lb.-in. load 95°, performing in ambient temperatures ranging from —65° to 200°F. Travel limit switches are integral and adjustable for strokes from 0 to 300°. Overall length is 4 5/32″, weight .56 lb.

Electropneumatic valve.

An electropneumatic poppet type valve features very low pressure drop. It was originally designed as a jet pump shut-off valve, can be used for many shut-off applications.



Linear actuator.

Specifications for a typical unit are 0.05 lb. per min. internal at 300 psig and 815°F. Ambient temperature range is —65°F to 300°F.

A 2″ diameter, aluminum butterfly air valve and actuator assembly offered by Barber-Colman is powered by a PYLC rotary actuator with a right-angle drive using a split-series drive motor and electromagnetic brake.

This assembly meets applicable parts of MIL-E-5272a. Radio noise filtering to MIL-I-6181 is provided. The actuator is mounted on the valve so that it fits a specific space envelope. It can be changed for other requirements.

Specifications for a typical unit are .10 lb./min. maximum internal leakage at 20 psig and 300°F. Maximum operating temperature is 300°F, maximum operating pressure 50 psig at 350°F. Weight, 1.8 lbs.

Circle No. 139 on Reader Service Card.

TRIMETHYL ALUMINUM

Trimethyl aluminum, a highly flammable liquid that ignites spontaneously in air, is being tested as a fuel and igniter for ramjet and turbojet engines by **U.S. Industrial Chemicals Co.,** div. of National Distillers Products Corp.

This liquid is being produced in pilot-plant quantities by Metalectro Corp., a subsidiary of U.S. Industrial Chemicals Co.

It is estimated that trimethyl aluminum can be produced commercially for $2 to $5 a lb. The price in pilot quantities is considerably higher.

Circle No. 138 on Reader Service Card.

TACAN TEST SET

Portable Tacan test set permits rapid ground testing of Tacan equipment while the equipment is in an aircraft. **The Federal Telephone and Radio Co.** FTR 3156 set provides rapid testing of frequency, sensitivity, power output, range, bearing and identity tone.

Unit weighs 17 lbs. and measures 9″ x 7″ x 11½″. Operating location can be up to 60 ft. from the aircraft. Power needed is 115 volts 60 to 1,000 cps. No direct connection to the aircraft is needed. The set is rainproofed.

Circle No. 102 on Reader Service Card.

RELIEF VALVES

Circle Seal relief valves and vacuum breakers, offered by **James, Pond & Clark, Inc.** for use with airborne electronic equipment and hermetically sealed electronic equipment, are said to provide the type of performance characteristic of a diaphragm-actuated relief valve.

The valve maintains a cracking pressure and reseating consistency over a wide range of temperatures. When it opens to pass excess pressure, it will reseat dead-tight, preventing loss of pressure in the container. Thus pressure remains constant and storage equipment is protected from moisture.

Circle No. 122 on Reader Service Card.

FUEL PUMP

A fuel pump for propellant-type fluids such as normal propyl nitrate has been developed by the **General Electric Co.'s Aircraft Products Dept.,** Hydraulics Section.

Designed for missile applications, the pump is capable of operating at high temperatures. At 260°F it pumps normal propyl nitrate at a rate of 0.50 gpm.

The ball piston concept of design provides rolling rather than sliding contact and a minimum of moving parts. Cylinder block bearing permits high-speed operation with fluids of low lubricity. Materials used in the pump are corrosion-resistant.

Circle No. 116 on Reader Service Card.

BALANCING MACHINE

A vertical balancing machine, capable of the dynamic balancing of equipment up to 5,000 lbs. in weight, 20,000 lbs. of thrust and measuring up to 36″ in diameter or 10 ft. in overall length, has been developed by **Aerophysics Development Corp.,** subsidiary of the Curtiss-Wright Corp.

The equipment was designed for the balancing of large rotating elements, such as rocket motors, rotating launchers, flywheels and turbo machines.

According to the manufacturer, rotating units weighing several hundred pounds have been balanced to an accuracy of about .000001 radian.

With slight changes in the suspension system, the test stand may be adapted for measuring jet misalignment

Is your Jet Engine RPM Measurement Accurate???

The NEW B&H Instrument

TAKCAL

• • • Reads Jet Engine Speed to Guaranteed Accuracy of 10 RPM in 10,000 RPM (±0.1%)

Checks Tachometer System

Adapts to any Frequency Problem

The inter-relation of RPM to efficiency and thrust in jet engines is fundamental. Proper adjustments for maximum thrust, engine life and safety of operation can be made only upon accuracy of instrumentation.

The new B&H TAKCAL incorporates a refinement of the frequency meter principle. It operates in the low (0 to 1000 cps) range, reading the frequency of the tachometer generator on a scale calibrated in percent RPM corresponding to the engine's RPM. In addition, the TAKCAL checks the tach system. The TAKCAL circuit and tachometer are parallel so that readings can be made simultaneously to determine the accuracy (or inaccuracy) of the aircraft's tach system. The TAKCAL operates during the engine run to properly set up engine controls for maximum economy and safety.

The TAKCAL's component parts are identical with those used in the J-Model JETCAL Analyzer. They are here assembled as a separate unit tester and for use with all earlier models of the JETCAL Tester.

The TAKCAL operates accurately in all ambient temperatures from —40°F. to 140°F. Low in cost for an instrument of such extreme accuracy, it is adaptable to application in many other fields.

Explosion-proof TAKCAL for special applications. Measures 200 to 7500 RPM, direct reading, with ±0.1% accuracy.

For full information write or wire

TAKCAL

West Coast Office: 437 S. Grand Ave., El Segundo, Calif.

B & H INSTRUMENT CO., INC.
3479 West Vickery Blvd., Fort Worth 7, Texas

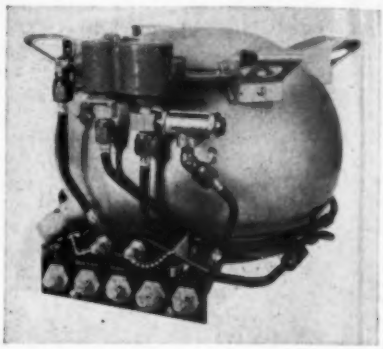
Circle No. 30 on Reader Service Card.

of motors of various sizes from 100 lbs. to 20,000 lbs. thrust.

Circle No. 119 on Reader Service Card.

LIQUID OXYGEN CONVERTER

A 5-liter liquid oxygen converter for military aircraft introduced by the **Aro Equipment Corp.** is said to offer improved performance through use of an economizer circuit.



Model 21043 is currently being used on the Lockheed F-104A. Its circuit reduces the amount of valving required in conventional liquid oxygen systems and is said to achieve greater efficiency in delivering oxygen for breathing to crew members.

Function of the circuit is to cause the supply flow to be taken from the top, or vapor phase, of the container during periods of excessive pressure.

Circle No. 118 on Reader Service Card.

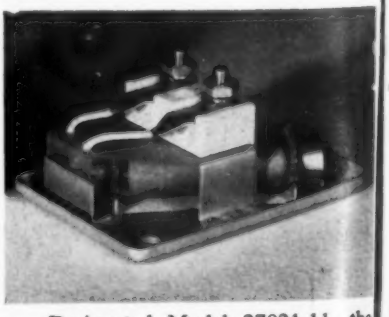
COMPASS MAGNETIC SHIELD

A Fernetic shield by **Magnetic Shield Division Perfection Mica Co.** confines the magnetic field radiated by the magnetron portion of airborne weather-mapping radar units as an aid to reducing need to recompensate the compass after radars are removed for maintenance.

Circle No. 113 on Reader Service Card.

FIRE DETECTOR

Fenwal Inc. has developed a fire detector for baggage compartments that is being installed in Class D baggage compartments of new DC-6s and DC-7s.



Designated Model 27021-11, the detector is a thin-shelled, hermetically sealed stainless steel unit weighing approximately 4.3 oz. Temperature adjustment range is from 50° to 350°F, but it can also withstand exposure to —65°F indefinitely and to a 2,000°F

These RECORD HOLDERS Use VICKERS® HYDRAULICS

VERTOL H-21 ARMY HELICOPTER
1199 Mile World's Distance Record for Helicopters, August 11, 1956

First Non-Stop Transcontinental Helicopter Flight with In-Flight Refueling August 23 and 24, 1956

SIKORSKY H-34 ARMY HELICOPTER
World's Speed Record for 100, 500 and 1000 Kilometers, July 12, 1956

The two craft shown here use Vickers pumps, motors and valves for a variety of important operations.

• • • • • • •

New and unusual applications for hydraulics are being scheduled into several of the newer helicopter designs. Among these are hydraulic motor operated fuel transfer pumps and hose reels. Vickers Hydraulic Equipment will also be used for taxiing, rotor fold, starting, rescue hoist systems and auxiliary electrical power generation.

• • • • • • •

Ask our nearest application engineer to tell you about them, or write for bulletin 7504.

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1502 • Detroit 32, Michigan

EL SEGUNDO DIVISION • Engineering, Sales and Service
2160 E. Imperial Highway, El Segundo, California

District Aircraft Sales and Service Offices:
Albertson, Long Island, N. Y., 882 Willis Ave. • Arlington, Texas, P. O. Box 213
Seattle 4, Washington, 623 8th Ave. South • Washington 5, D.C., 624-7 Wyatt Bldg.
***Additional Service facilities at:* Miami Springs, Florida, 641 De Soto Drive**
TELEGRAMS: Vickers WUX Detroit • TELETYPE: "ROY" 1149 • CABLE: Videt
OVERSEAS REPRESENTATIVE:
The Sperry Gyroscope Co., Ltd.—Great West Road, Brentford, Middx., England

REPRESENTATIVE VICKERS HYDRAULIC EQUIPMENT FOR HELICOPTERS

Electrical Power Package
600 lb Rescue Hoist System
Automatic Two-Speed Valve
Solenoid Operated Four-Way Valve
Variable Displacement Piston Type Pump
Constant Displacement Piston Type Motor
Constant Displacement Piston Type Pump

7637

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

flame for short periods.

A two-wire unit affixed to a separate terminal block, the detector is mounted on a slotted cover plate that fits existing electrical boxes. Contacts close when temperature rises above the set-point.

Current rating is 5 amps. at 125 volts ac, 2 amps. at 28 volts dc and 1 amp. at 48 volts dc.

Circle No. 104 on Reader Service Card.

GYRO TEST TABLE

A **Micro Gee Yaw Products, Inc.** rate table, Model 80A, employs an optional automatic rate programmer that permits rate to be programmed as a function of time. Table can subject a 10-lb. load to rates of 0° to 300° per minute and can be fitted into a 20" x 20" chamber.

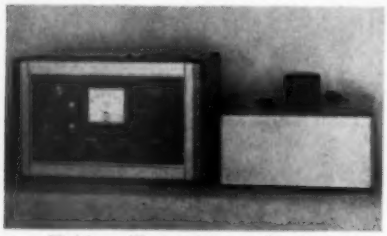
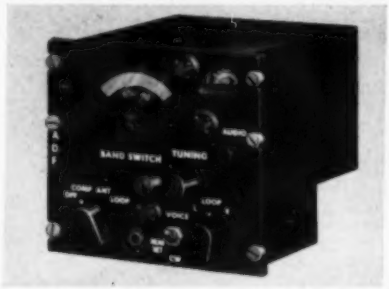


Table will operate under temperatures from —67°F to 187°F to altitude conditions of 60,000 ft. Control panel and amplifier unit can be remotely located and either table or rack mounted.

Circle No. 110 on Reader Service Card.

AUTOMATIC DIRECTION FINDER

Lightweight ADF designed by **The Magnavox Co.** weighs less than 30 lbs. and uses a specially designed loop antenna electrically interchangeable with the AS-313B loop.



The new loop protrudes only 2½" from the aircraft fuselage and can be flush-mounted for supersonic aircraft.

Circle No. 111 on Reader Service Card.

HIGH-TEMPERATURE CAPACITOR

Balco Research Laboratories capacitors employing processed Teflon dielectric were developed for Air Force applications requiring high performance to 200°C. Power factor is less than 0.0005 and Q's are above 2,000.

Standard units have insulation resistance above 10^9 ohms at 200°C. Dielectric is said to hold an initial charge the longest of any known material.

Units are of extended foil construction and encased in hermetically sealed tubular metal containers. Tolerances are ± 10%. Capacitance ratings are from 0.001 to 2 mfd. Voltage ratings of 150 to 4,000 volts DC are available.

Circle No. 103 on Reader Service Card.

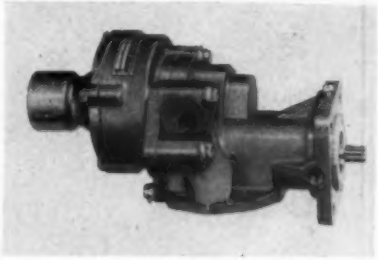
MOLDED PRINTED CIRCUITS

A standardized panel for printed circuits using a 1/10" grid system has been put to use by the **Westinghouse Electric Corp.** for use in aircraft equipment. Arrangement of the circuits is based on best manufacturing advantages for improved reliability.

Circle No. 114 on Reader Service Card.

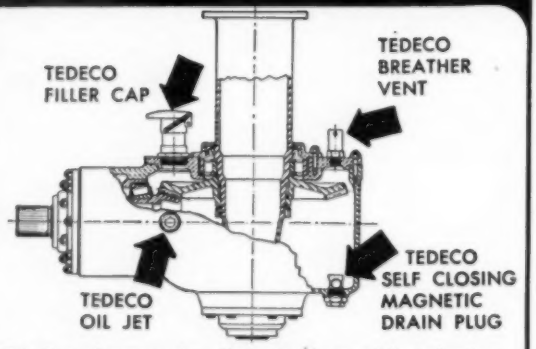
HIGH-PRESSURE FUEL PUMP

A high-pressure fuel pump offered by **Lear, Inc.'s Lear-Romec Div.** is designed for gas turbine fuel systems.



Model RR16060B is the rotary-gear, positive displacement type with a built-in centrifugal fuel booster pump

GEAR CASE ACCESSORIES DESIGNED FOR AIRCRAFT



This line of accessories eliminates the need for adapting general manufacturers' equipment to aircraft requirements. Tedeco Gear Case Accessories are designed and manufactured with careful consideration for material strength, for safety of flight, for weight saving, and for military and aeronautical specifications. Used extensively by major aircraft manufacturers on military and commercial equipment.

MAGNETIC DRAIN PLUGS (Both self-closing or conventional)
FLEXIBLE DRAIN LINE UNITS
LUBRICATION OIL JETS
BREATHER VENTS
OIL FILLER CAPS

Send for our catalog for complete information and dimension drawings.

TECHNICAL DEVELOPMENT CO.
P. O. BOX 82 • GLENOLDEN, PA.

Circle No. 31 on Reader Service Card.

THE "HOTTEST" LUBRICATION PROBLEM IN AVIATION TODAY

The stainless steel mechanisms for opening and closing after-burner shutters of jet engines require lubrication at extreme temperatures. For the past 5 years Molykote-Silicone has been used extensively in this application.

This is but one of the many case histories covered in Field Report #1 on Aircraft applications of MOLYKOTE Lubricants. Others include lubrication of spline drives, ball and socket joints, exhaust stack joints, threaded connections, neoprene shaft reels, linkage assemblies, activators, turbine bearings, etc.

The excellence of MOLYKOTE Lubricants in aircraft applications hinges on their excellent thermal stability at high and low temperatures, and extreme bearing pressures. Send today for complete information.

THE ALPHA MOLYKOTE CORPORATION
Main Factories: 65 Harvard Avenue, Stamford, Conn.
71 Arnulfstrasse, Munich 19, Germany

7511

Circle No. 32 on Reader Service Card.

Frozen on the outside, warm and ready to go on the inside!

The "Mars" makes the difference*

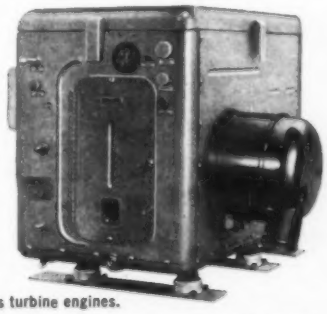
EXTREME COLD in Arctic operations has little effect on the compact, reliable Mars auxiliary power unit used on the Boeing KC-97 tanker. Often running continuously day in and day out, the dependable Mars-powered generator set keeps the cabin comfortable at below-zero temperatures. It supplies electric power also for engine preheating and starting systems as well as for other auxiliary equipment.

Solar's 50 hp Mars gas turbine is the heart of the airborne power unit. The Mars engine weighs less than 100 pounds, is smaller than a two-foot cube. It starts easily from 130F to −65F ambient temperatures, operates on a variety of fuels, is simple to maintain, and requires infrequent overhauls. In addition to the KC-97, Mars auxiliary power units are employed on the Douglas C-124C, the Lockheed C-121C and Convair C-131B.

Perhaps the Mars gas turbine can help solve your need for a light, compact, powerful engine. Write to Dept. C-130, Solar Aircraft Company, San Diego 12, California, for more data on the Mars gas turbine.

WRITE FOR BOOKLET

New brochure describes Solar gas turbines—how they work, advantages they offer. Ask for a copy.



SOLAR
AIRCRAFT COMPANY
SAN DIEGO
DES MOINES

*Mars is the registered trade mark for Solar's line of 50 hp gas turbine engines.

Circle No. 11 on Reader Service Card.

"CUSTOMER SERVICE"

Extra diligent customer service is another outstanding characteristic of Narmco's continuing efforts to provide the aircraft industry with the most advanced structural materials.

Users of Narmco materials have at their constant service a field engineering organization supported by the industry's most experienced team of research, development and testing authorities devoted exclusively to structural plastics and adhesives.

When problems—large or small—involve the application of structural adhesives or structural laminating, you can count on Narmco for the kind of assistance that leads to a prompt solution—and better aircraft components. Extra diligent customer service from Narmco can also lead to more efficient, more economical production!

Narmco Resins and Coatings Company is a prime manufacturer of a wide variety of high strength "Metlbond" structural adhesives. "Conolon" laminating materials, and coated fabrics—each specifically designed to meet the requirements of either primary or secondary aircraft construction. Narmco also produces an extensive line of putties, resins and sealers for use in the fabrication of aircraft components.

For over a decade, Narmco structural materials have been widely utilized in commercial and military aircraft, wherein they have demonstrated their utmost reliability in high performance applications.

NARMCO

PIONEERING THROUGH RESEARCH

Narmco technical field representatives throughout the United States and Canada can assist in solving your structural design problems quickly, efficiently and economically. For immediate assistance, write, wire or telephone . . .

NARMCO RESINS & COATINGS COMPANY, Dept. 873 600 Victoria Street, Costa Mesa, California

and a mounting pad for gear-driven fuel meter control.

Aluminum body contains an inlet port, discharge port and a port for relief valve return line.

Rated capacity is 9.4 gpm at 6,000 rpm and 700 psi gauge discharge pressure pumping MIL-F-5624, grade JP-4 fuel at 110°F with 20 psi absolute inlet pressure. Power requirement is 8.4 hp maximum at rated capacity.

Circle No. 117 on Reader Service Card.

SENSING ELEMENT

A temperature sensing element designed for use with **Barber-Colman Co.** automatic aircraft temperature control systems features two independent resistance circuits.

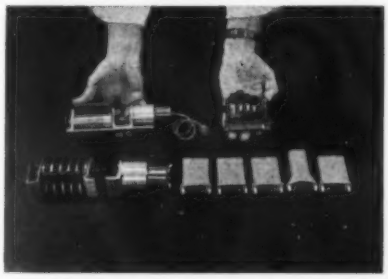
The element is said to be especially suitable for high-temperature, high-pressure duct application. Resistance temperature characteristics meet Specs. MIL-b-5495.

Operating temperature range is -65°F to 600°F. Mating electrical connector limits maximum ambient temperature. Other versions are available for temperatures up to 1,000°F.

Unit shown measures 2⅛" overall, weighs 1 oz.

Circle No. 121 on Reader Service Card.

TUBELESS ANALOG COMPUTER



Westinghouse Electric Corp.'s electronic tubeless computer (WETAC) uses an all-transistorized amplifier which employs a feed-back loop to correct for temperature deviations in transistor characteristics.

Used in a servo amplifier application, the computer consists of amplifier, servo motor, gear box and a bank of potentiometers. Weight was reduced from 33 to 4 oz. Size has also been sharply reduced. Low power consumption is featured, especially during nulls when the consumption is one watt, compared to 40 previously consumed.

Circle No. 112 on Reader Service Card.

ANCHOR NUT

An all-metal self-locking anchor nut offered by **The Kaynar Co.,** the Kaylock K1000, features lighter weight and thread-relief design.

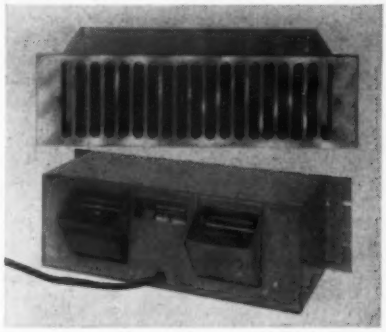
First of a series of redesigned anchor nuts, the K1000 is interchangeable with and far lighter than other designs, including former Kaylock designs. Sizes 10-32 and ¼"-28 reduces weight by 23%.

The thread-relief design eliminates threads in bearing and is said to help insure a structurally sound joint. Available in a complete range of sizes from 8-32 through 3/8"-24.

Circle No. 120 on Reader Service Card.

ELECTRONICS COOLING FAN

McLean Engineering Laboratories rack-mounted cooling fan for electronics equipment is designed to fit 5¼" panel heights in standard 19" racks and



BIG NEWS ABOUT A LITTLE PRODUCT

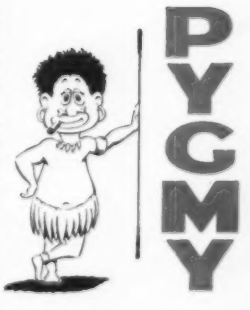
(ACTUAL SIZE)
Bendix "PYGMY" Electrical Connectors
Gold Plated Contacts
Closed Entry Sockets
Resilient Scinflex Insert
Alumilite or Cadmium Plate Finish
Two Quick Disconnect Couplings—Double Stub Quick Action Thread or Three-Point Bayonet Lock
Light Weight
Small Envelope Size
Maximum Serviceability
Can be pressurized to current MIL-C-5015 specification
High Strength Aluminum Shells
Variety of Styles Available—General Duty, Environmental Resisting, Potting Types, Jam Nut Receptacles, Hermetically Sealed Receptacles
Wide Choice of Insert Patterns (1 to 55 contacts)
Designed especially for miniaturized Electronic Equipment

New "PYGMY" Connectors for Miniaturized Electronic Equipment Installations

Although the newly developed "Pygmy" line of miniature electrical connectors is approximately one third smaller in size and weight than the standard Bendix* AN connector, they provide the same outstanding qualities of serviceability, ruggedness, reliability and resistance to vibration, moisture and corrosion for which all Bendix connectors have become world famous.

If you have an application for miniaturized electronic equipment requiring lighter and smaller connectors than standard AN types, you'll find Bendix "Pygmy" connectors the best possible solution. Write for complete detailed information. SCINTILLA DIVISION OF BENDIX AVIATION CORP., SIDNEY, N. Y.

*REG. U.S. PAT. OFF.



Scintilla Division

SIDNEY, NEW YORK

Bendix AVIATION CORPORATION

Circle No. 33 on Reader Service Card.

can also be supplied for 24" and special racks.

Two blower wheels provide 150 cfm of air through stainless steel grills and filters. Models are available for dc and 400-cycle operations as well as the standard 60-cycle unit.

Circle No. 107 on Reader Service Card.

SOLENOID VALVE

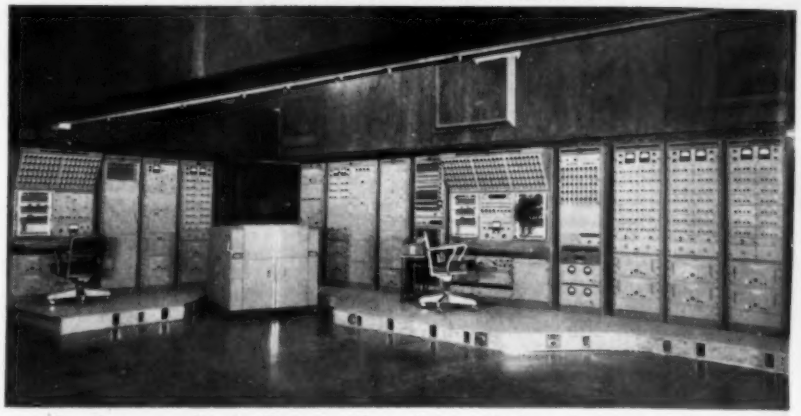
A 24-volt dc solenoid valve offered by **Marotta Valve Corp.** controls air temperatures to 1,000°F and air pressures to 4,000 psi.

Designated Model MV36R, the valve is normally closed under test and is the ½" AND tube size. It is also supplied in size ranges from ¼" to 2".

Final temperature ratings have not yet been established. However, more than 50 tests are said to have been accomplished with line fluid temperatures between 700°F and 1,000°F.

Circle No. 105 on Reader Service Card.

ELECTRONIC COMPUTER SERVICE



Small companies in Europe who cannot afford to invest in their own computation facilities will have an analog computation facility provided by **Electronic Research Associates, Inc.,** together with a staff of scientists for problem analysis and programming.

ERA will establish a computing center in Brussels as a service for rental on hourly, weekly or monthly basis to all European nations early this year.

Circle No. 109 on Reader Service Card.

SHUTTLE VALVE

A shuttle valve that provides the dead-tight sealing often required in aircraft, missile and rocket applications where leakage cannot be tolerated is offered by **James, Pond and Clark.**

Trade-named Circle Seal, the valve is designed for gas service but is equally suitable in hydraulic or other liquid service where detent action is not required.

The manufacturer says the valve seals tight not only with air and nitrogen but also with lighter gases such as helium and hydrogen.

The unit has a free shuttle guided by inlet and outlet fittings. Sealing is accomplished by utilizing the floating C-ring principle, which insures perfect line of contact.

Circle No. 129 on Reader Service Card

(*More New Products on Page* 73)

STANDARD FACTORS CORPORATION

Announces its

NEW PURCHASE LEASEBACK FINANCING

Features:

1. **Acquisition of new aircraft.**
2. **Purchase and leaseback of present equipment.**
3. **Conditional sales contract purchases.**

For detailed information, please communicate with Edwin B. Meredith, Executive Vice President.

If you are operating on limited working capital, restricting expansion of your operation, Standard's Creditaire Division will finance the purchase of new equipment, then lease it back to you. Lease charges are income tax deductible.

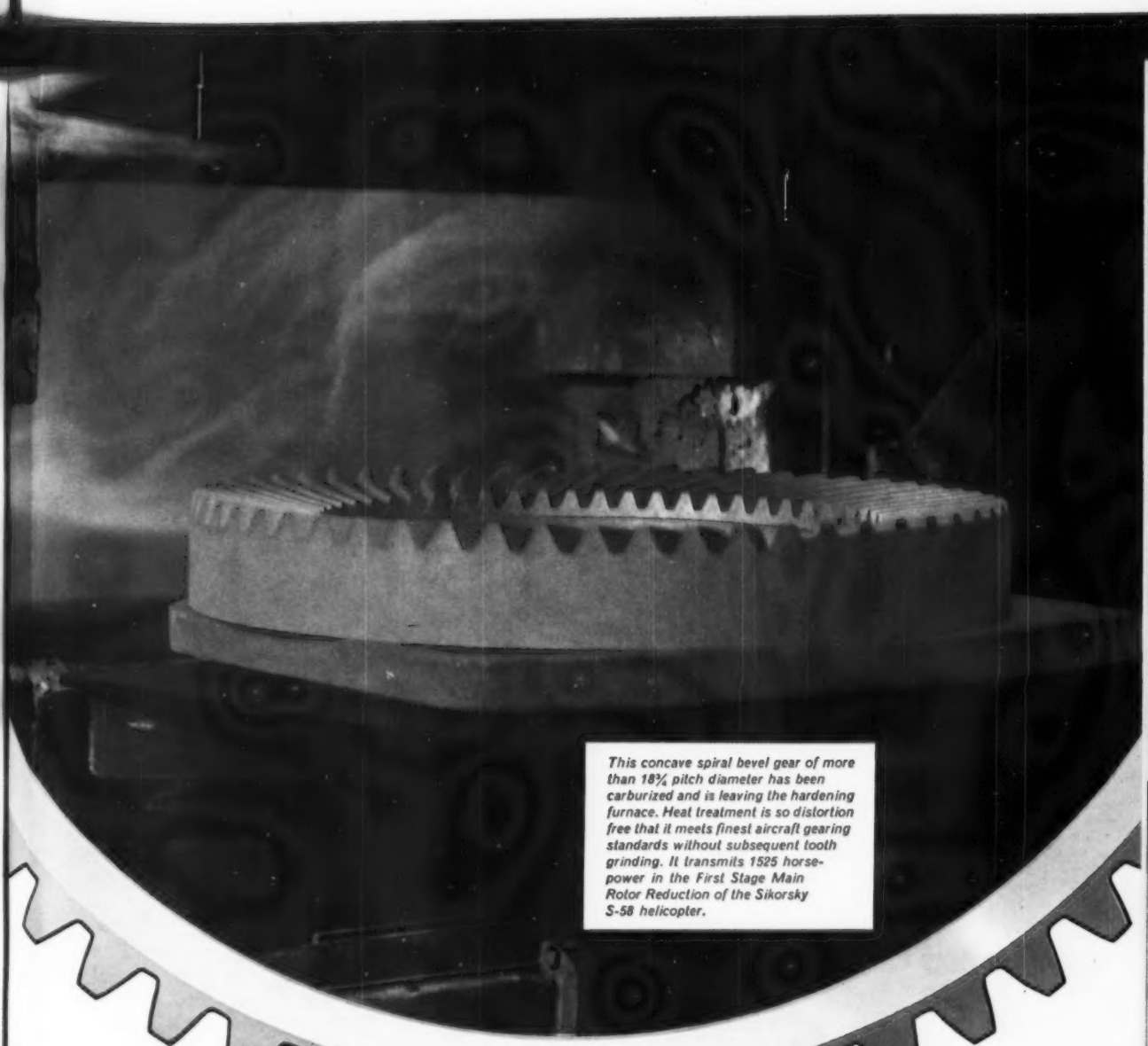
You can, if you wish, initiate a continuous replacement program by selling your old aircraft and acquiring new. Standard will finance the sale of the older equipment to other airlines on a "pay out of profits" plan, and finance the purchase of your new equipment for you on a leaseback arrangement or under a conditional sales contract.

Every leaseback is tailored to fit the particular needs of the operator.

STANDARD FACTORS
Corporation

403 W. Eighth St., Los Angeles 14, Calif. TRinity 1061
270 Madison Avenue, New York 16, N. Y. MUrray Hill 9-4488
209 S. LaSalle St., Chicago 4, Ill. Financial 6-3051

Circle No. 34 on Reader Service Card.



This concave spiral bevel gear of more than 18¾ pitch diameter has been carburized and is leaving the hardening furnace. Heat treatment is so distortion free that it meets finest aircraft gearing standards without subsequent tooth grinding. It transmits 1525 horsepower in the First Stage Main Rotor Reduction of the Sikorsky S-58 helicopter.

PRECISION
is Our *Only* Product!

● Everything at I.G.W. is geared to precision. You'll find a "feeling" for precision not just in inspection and production and engineering, but also in maintenance and shipping and on throughout the company. It's the basic reason why I.G.W. is *the* recognized source for precision gears

INDIANA GEAR WORKS, INC.

INDIANAPOLIS 7, INDIANA

Completely TRANSISTORIZED AMPLIFIER & SERVO MOTOR

Heat rapidly dissipated by unique heat-sink design.
No output transformer needed—amplifier works directly into Oster-designed size 10 servo motor with center tapped control winding.

AMPLIFIER DATA

- Input Impedance: 2500 ohms.
- Load Impedance: 250 + JO ohms. This is the 400 cycle stall impedance of an Oster Type 10-5054-03 servo motor control phase when resonated with 2.0 microfarad capacitor.
- Power Gain (open loop conditions—no negative feedback): 50 D. B. minimum.
- Power Output: 0.5 watt minimum.
- Power Requirements:
  + 19.5 Vdc—250 ma.
  + 4.5 Vdc— 20 ma.
  + 8.5 Vdc— 6 ma. (regulated ± 5%)
- Amplifier Rating: 0.5 watt min. at 25°C.
- Environment proof operation assured by encapsulation of amplifier assembly.

SERVO MOTOR DATA

- With .015V at 400 cycles applied to amplifier input, motor pinion rotates 5000 RPM minimum under no load conditions.
- With .075V at 400 cycles applied, motor develops .15oz.-in. minimum stall torque. Minimum speed 6200 RPM under no load conditions.
- Up to 0.2 oz.-in. torque can be obtained by energizing the reference phase with 31.0V if motor has an adequate heat sink. This results in a reference phase current of approx. .210 amperes.

Engineers for Advanced Projects:
Interesting, varied work on designing transistor circuits and servo mechanisms. Contact Mr. Zelazo, Director of Research, in confidence.

Input impedance variations to meet your specific requirements can be made. Write for additional information today.

Other products include actuators, servos, synchros, AC drive motors, servo mechanism assemblies, DC motors, motor-gear-trains, fast response resolvers, servo torque units, reference and tachometer generators, synchro indicators and motor driven blower and fan assemblies.

John Oster
MANUFACTURING CO.
Your Rotating Equipment Specialist

Avionic Division
Racine, Wisconsin

BURTON BROWNE ADVERTISING

Circle No. 22 on Reader Service Card.

INSULATED TERMINALS

A line of insulated terminals produced by **Globe Electrical Mfg. Co.** are designed for chassis rather than phenolic board mounting to eliminate board breakage problems.

High voltage breakdown runs to 15 kilovolts. Standard terminals are gold-plated for easy soldering. Tailored units can be supplied for specific applications.

Circle No. 101 on Reader Service Card.

POTENTIOMETER

A jewel-bearing subminiature wirewound potentiometer, for applications requiring minimum starting and running torque, has been developed by **Ace Electronics Associates, Inc.**

The jewel bearings of the Acepot, as it is trade-named, are said to provide not only extremely low torque but also seal against abrasive dust or any other foreign matter.

Specifications include: torque, .01 oz./in.; size ½" x ½"; resistance range, 10 ohms to 250K standard; linearity ± .3%; power rating, 2 watts for 60°C rise; weight, ¼ oz.; temperature, —55°C to 150°C.

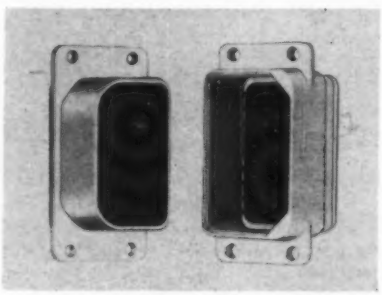
Circle No. 160 on Reader Service Card.

RACK & PANEL CONNECTOR

Scintilla Div., Bendix Aviation Corp., has developed a new type rack and panel electrical connector that incorporates a solid shell and resilient insert to facilitate pressurization and give maximum protection against vibration.

Designated the SR type connector, it is easily pressurized to latest MIL specification.

Other features include low contact engagement forces, closed entry sockets, heavily gold-plated contacts, cadmium-plated clear irridite finish and an operating temperature range of —67°F to 250°F.

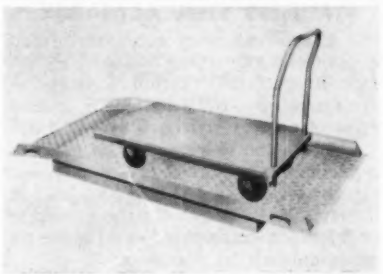


Insert patterns will be available to mate with existing equipment in service.

Circle No. 100 on Reader Service Card.

ALUMINUM HAND TRUCKS

Voltz Brothers, Inc. has announced a new line of Met-L-ite aluminum hand trucks and dock boards embodying construction features designed to make handling of materials easier.



The trucks have a deck with rounded corners and an adjustable wheelbase for a short or long turning radius. Dock boards have a safety tread plate, rounded curbings with hand grips and beveled edges.

Available in standard sizes: widths from 24" to 40" and lengths 36" to 72", with capacities to 2,000 lbs. Catalog available.

Circle No. 106 on Reader Service Card.

TEMPERATURE TEST CHAMBER

A temperature test chamber for ambient testing of products up to 600°F has been introduced by **Statham Development Corp.**

Designated Model TC-4, the unit has 600 cu. in. of working space. For continuous operation of the test chamber, extra interchangeable test trays are

Stop Surface Corrosion FAST and ECONOMICALLY with CEE-BEE's Cleaning and Brightening Method

You can eliminate costly aircraft skin replacement caused by surface corrosion with CEE-BEE's 1-2-3 cleaning and brightening materials. The CEE-BEE method is fast and economical – minimizes man hours required on the job and "out-of-service" time of equipment – provides a longer lasting clean surface, free from corrosion causing oil, smoke and exhaust stains and traffic film. And with CEE-BEE, extra polishing retains hi-lustre longer.

Write for free brochure.

1
CEE-BEE
brightener and cleaner is applied with low pressure spray or brush
2
CEE-BEE
brightener and cleaner is brushed to insure coverage, no scrubbing necessary
3
CEE-BEE
brightener and cleaner is water rinsed and allowed to air-dry to bright corrosion free finish

CEE-BEE

CEE-BEE CHEMICAL CO., INC.
9520 East CeeBee Drive
Downey, California

CB 356

Circle No. 35 on Reader Service Card.

available. Each tray has 15 openings of 3/8" diameter to provide for electrical or mechanical connections to the product being tested.

Literature is available.

Circle No. 161 on Reader Service Card.

STAINLESS STEEL ACTUATOR

A stainless steel actuator offered by Ex-Cell-O Corp. is designed to operate hydraulically within a temperature range of —67°F to 600°F, over a range of pressures from 0 to 3,000 psi.

The actuator can also be adapted to pneumatic operation. Prototypes have a stroke of 7", are 16" long and 2 3/8" in diameter. Basic design can be altered to meet specific performance and space requirements of the customer.

Circle No. 162 on Reader Service Card.

SILICONE RUBBER

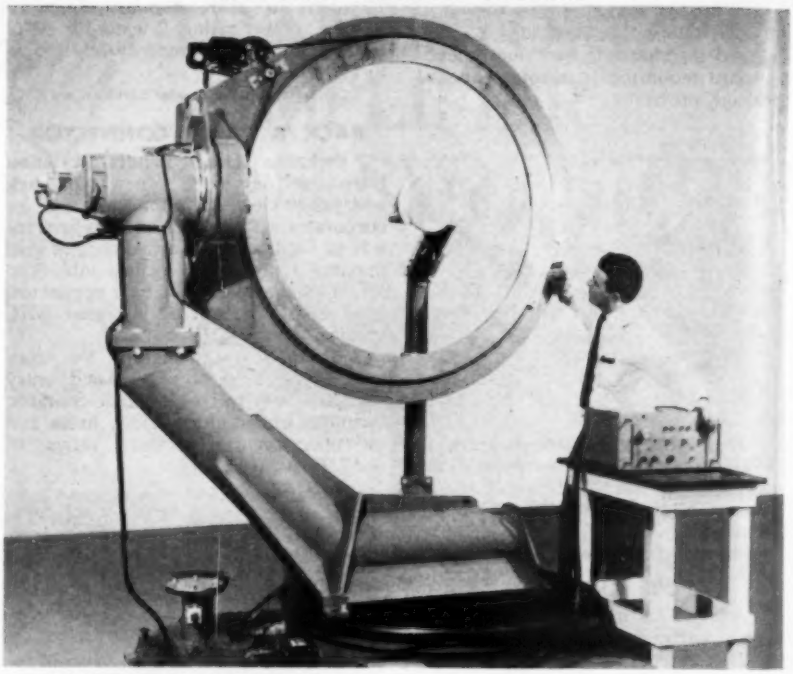
A new silicone rubber identified as Silastic Type K Interlayer has been developed by **Dow Corning Corp.** in conjunction with Wright Air Development Center.

Type K interlayer was developed to overcome the inability of conventional safety glass interlayer to withstand the intense frictional heat generated by potential aircraft speeds.

According to the manufacturer, Type K retains full strength and clarity at temperatures ranging from —65° to more than 350°F. When laminated and cured under pressure, it forms a tough, rubbery interlayer with excellent optical properties.

Circle No. 163 on Reader Service Card.

RADOME TESTING SYSTEM



California Technical Industries has a CTI radome boresight-error measuring system, Model 150, for checking the performance of radar tracking systems. The system automatically records radar beam deflection as a continuous function of radome position.

A motor-driven radome holding fixture rotates and three recorders synchronized with the radome position plot magnitude and horizontal and vertical components of beam deflection angle.

Circle No. 108 on Reader Service Card.

(*More New Products on P.* 77)

A little pull in the right place . . .

the ROBINSON wire twister

Aircrafts' Who's Who Reports

A cross section of the Who's Who in the aircraft industry—including Douglas, Allison, Fairchild, Grumman, Martin, Republic, Canadair Ltd., Pratt and Whitney among a host of others — is reported to have reduced engine wiring time as much as 66%. This saving is effected by the use of the new Robinson Wire Twister, an improved model of the ones that have seen service with the army, navy and airforce since 1943. Improvements include the exclusive diagonal jaw design that permits easier access to hard-to-reach areas, and clamps a vice like grip on the wire by pulling it into a 30° bend thus delivering added leverage for twisting.

In addition to the greatly increased engine wiring speed, users attest to improved shop safety — fewer skinned knuckles and bruised fingers.

Besides their production line assignments, Robinson Wire Twisters readily adapt in the shop to bench work, on radio and radar equipment, on magnetos, carburetors, instruments and sub-assembly work of all kinds.

List price is $18.50. Write for fully descriptive literature to Ralph C. Robinson Company, Dept. M, Box 3494, 2516 Crosby Way, North Sacramento 15, California.

. . . saves 2/3 the usual wiring costs

the ROBINSON wire twister

Circle No. 36 on Reader Service Card.

JOHNNIE MARTIN,
ONE OF AMERICA'S
VETERAN TEST PILOTS
SALUTES
COMMANDER 680 SUPER

Performance

"We find in the Aero Commander 680 Super the highest cruising speeds coupled with low maintenance costs plus excellent stability and control, especially in the approach and landing configuration, making this airplane a dream come true to all pilots who fly it."

Johnnie Martin

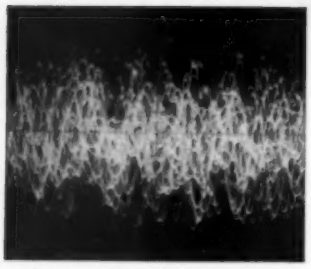
J. F. "Johnnie" Martin, assistant director of Flight Test for Douglas Aircraft Company is recognized as one of the nation's outstanding test pilots. From his first solo flight, back in 1927, Johnnie's life has been a continuing experience in flying and testing airplanes. As the Douglas test pilot, he tests all types of aircraft, including the record holding "Skystreak" and "Skyrocket." He was chief pilot for Douglas before being elevated to his present position.

AERO *Commander*

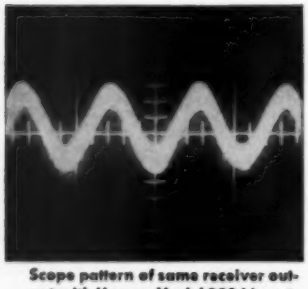
For complete information see your nearest Aero Commander distributor or write for Catalog 129-S

AERO DESIGN & ENGINEERING CO • TULAKES AIRPORT • P.O. BOX 118 • BETHANY, OKLAHOMA

Circle No. 23 on Reader Service Card.



Scope pattern of receiver output with 50 microvolt MCW signal in the presence of precipitation static. Signals less than 2,000 microvolts are not readable.



Scope pattern of same receiver output with Hoover Model 2004 inserted in the antenna circuit. Signals as low as 5 microvolts are readable.

"There must be some way to beat this static!"

There is! If this aircraft were equipped with a Hoover 2004 Interference Blanker, the pilot could read the tower loud and clear despite the precipitation "noise" which is now crippling his radio reception. He would get reliable reception under adverse conditions—when he needs it the most.

Extensive tests of this unit by military and our own laboratories demonstrate remarkable communication improvement in the presence of the impulse static normally encountered in modern high altitude, high-speed aircraft.

The Hoover Interference Blanker —compact in a ¼ ATR package weighing 5½ pounds and using either 28 VDC or 110 VAC prime power—markedly increases the performance and reliability of your vital electronic navigation, direction finding or communication equipment. For complete engineering information, write to Department B-1.

ATTENTION ENGINEERS

Hoover Electronics offers you a unique opportunity to work in a wholesome environment that enables you to exploit your creative talents and help you grow in your profession. Write to Personnel Director.

HOOVER ELECTRONICS CO.

3640 WOODLAND AVE. • BALTIMORE 15, MD.

Subsidiary The Hoover Company

PARTS CLEANING MACHINES

Circo Equipment Co. has introduced three new small metal parts cleaning machines.

Models MPC-3 and MPC-4 are pneumatically operated power agitation cleaners, fully automatic. They can be used cold and are also available with steam, gas or electric heat.

Model MPC-5 (shown) is described as a motor-operated, low-cost machine that does not require the use of a skilled operator.

Circle No. 115 on Reader Service Card.

New Product Briefs

• **Chemical Consulting Service** has developed a strip-coating, trade-named Strip-Kote, for the protection of metal finishes, plastic, marble, porcelain and glass surfaces. It's a milky-colored emulsion which, when dry, becomes a tough, transparent film. It may be applied by brush or spray gun.

Circle No. 130 on Reader Service Card.

• Tubeless military aircraft tires designed to withstand temperatures of —65° F and lower in tests simulating Arctic cold have been developed by the **Goodyear Tire & Rubber Co.**

Circle No. 134 on Reader Service Card.

• **Allis-Chalmers Manufacturing Co.** has developed new type axial compressors for extended range of operating conditions, said to be particularly adaptable for windtunnel test facilities.

Circle No. 135 on Reader Service Card.

• A dual spindle lathe designed to provide facilities for turning both large and small-diameter work is offered by **The Boyes & Emmes Machine Tool Co.** It is built to support 15 tons between centers. Beds may be obtained in any required length.

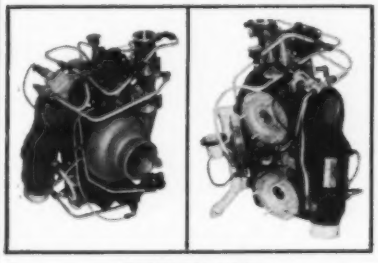
Circle No. 136 on Reader Service Card.

• **The Polymer Corp.** is producing Teflon tubing in AWG wire sizes of 0, 1, 2, 3, 4, 5, 6, 7, 28 and 30, trade-named Polypenco Teflon spaghetti tubing. It has been currently available in sizes 8 through 26.

Circle No. 137 on Reader Service Card.

Lockheed C-130A Hercules uses Stratos 2-Pad Bleed Air Turbine as generator, hydraulic drive

A single constant speed air turbine drive does double duty aboard Lockheed's C-130A Hercules logistics carrier. The 45 hp unit, built by Stratos, operates on air bleed from the engine compressors and drives both a 400 amp generator



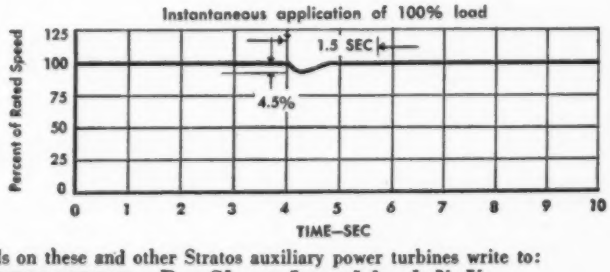
MODEL TP25-2A
Constant Speed 2-Pad Air-Turbine Drive

and a hydraulic pump. Nominal output at the 6,000 rpm generator pad is 25 hp while the nominal rating at the 3,500 rpm hydraulic pump pad is 18 hp. Fully qualified, the unit, Stratos Model TP25-2A, automatically maintains constant output speed regardless of input conditions or load. The integral overspeed protection has been proved reliable. Compact and light, the unit can be used in many applications where two sources of mechanical power are required.

Shaft speeds other than the 6,000 and 3,500 rpm ratings of the —2A model can be provided. Likewise, the available horsepower can be divided in other proportions to meet other requirements. Since such variations would require only a minimum amount of changes in gearing, units to meet specific requirements can be developed quickly.

While the model TP25-2A — newest of Stratos' line of constant speed turbine drives — is used to drive a DC generator in the C-130A application, speed control accuracy makes it suitable for use with alternators. As in other models, the fast-acting governor holds output speeds within ¼ of 1% from no load to overload conditions at all altitudes. The units are extremely rugged — models of the TP25 series have been whirl tested at 9Gs under full load to simulate aerobatics. Even under such conditions, speed variation was only 1.9 per cent.

Speed Control Characteristics of the TP25-2A during typical transient condition



For details on these and other Stratos auxiliary power turbines write to:

STRATOS *— Bay Shore, Long Island, N. Y.*

A Division of Fairchild Engine and Airplane Corporation

West Coast Talk . . . By Fred S. Hunter

- **Hughes may become major helicopter producer.**
- **Clarifying operations of Hughes companies.**

KEEP YOUR EYE on Hughes Tool Co.'s lightweight, two-man Model 269 helicopter. If it's successful—and all indications point in that direction—Hughes Tool's aircraft division will be established as an important producer in the helicopter field.

Hunter

Remember a while back when the governor of Florida made quite a fanfare of an announcement Howard Hughes planned a huge new manufacturing facility in that state? This is it. There have been no recent communiques from the gubernatorial offices in Tallahassee, so the current Hughes thinking on this phase of the future of the tool company's aircraft indivision is not evident. However, if quantity production results from the Model 269 it probably will be moved from Culver City, Calif.

Hughes has had such a move in mind for a long time. Once he decided on Las Vegas, Nev. and bought land there. Then he considered Tucson or Phoenix, Ariz., but finally fixed on Florida. Hughes, incidentally, has been in Florida this winter. It also should be noted that Hughes Tool has gathered a top-notch engineering staff in its helicopter section and has another likely-looking design in the works, plus various study projects.

* * *

This should be as good a time as any to talk about the difference between the Hughes Tool Co.'s aircraft division and the Hughes Aircraft Co. It's easy to understand why so many people confuse the two. Both are located on the same site at Culver City and even have the same telephone number. Howard Hughes is president of both companies. Originally, Hughes Aircraft Co. was a part of the Hughes Tool Co. Now, however, it is owned 100% by the Howard Hughes Medical Institute, a nonprofit foundation formed by Hughes.

Main products of the Hughes Aircraft Co. are the Falcon missile and fire control systems for interceptors. All profits from their production go to the medical foundation. Hughes Aircraft Co.'s direct operating head is E. A. Hyland, who is vice president and general manager. On the other hand, the aircraft division of Hughes Tool Co. is exactly what the name implies. As an operating division, any profits are added to the net earnings of the Hughes Tool Co. Any losses may be written off. The Hughes flying boat is a venture of the aircraft division of the Hughes Tool Co., which is also active in subcontracting. The Hughes Tool Co. is owned 100% by Howard Hughes individually. Operating head of the aircraft division is R. E. Hopper, who is vice president and general manager.

* * *

Lockheed is generally credited with being the company most active in pursuit of a Mach 2 jet transport design. But fact is everybody has some sort of a study project going. No one, however, has yet come up with a design that might be economical enough for airline operation. No one, to our knowledge, is thinking in terms of less than Mach 2. If you pay for the drag rise to go supersonic, you might as well go to Mach 2, it costs so little more. And if you don't you may be sure your competitor will.

* * *

Slick Airways has been talking to Douglas about a DC-7C with big doors and a cargo floor. This would require considerable re-engineering and the manufacturer would need more orders to make it pay out. Douglas is making a study and if other carriers should show interest, may have a go at it. Another airline asked Douglas to do a study on a DC-7 turboprop conversion with Rolls-Royce Tyne engines, but it didn't appear promising.

* * *

Palmdale, Calif. Chamber of Commerce negotiated a deal with Northrop Aircraft for installation of a large-scale model F-89 atop its building to symbolize its claim that Palmdale is now the jet capital of the world . . . North American Aviation has its "Mach Busters Club" for those who fly faster than sound in F-100s; Lockheed has its "Order of Star Fighters" for those who pilot the supersonic F-104 and Convair passes out delta wing pins to pilots who fly the F-102 . . . Aviation applications are scheduled to come first in Litton Industries' program for developments to make use of the Paramount color television tube, then industrial uses.

To the ENGINEER of high ability

Through the efforts of engineers The Garrett Corporation has become a leader in many outstanding aircraft component and system fields.

Among them are:

air-conditioning
pressurization
heat transfer
pneumatic valves and controls
electronic computers and controls
turbomachinery

The Garrett Corporation is also applying this engineering skill to the vitally important missile system fields, and has made important advances in prime engine development and in design of turbochargers and other industrial products.

Our engineers work on the very frontiers of present day scientific knowledge. We need your creative talents and offer you the opportunity to progress by making full use of your scientific ability. Positions are now open for aerodynamicists . . . mechanical engineers . . . mathematicians . . . specialists in engineering mechanics . . . electrical engineers . . . electronics engineers. For further information regarding opportunities in the Los Angeles, Phoenix and New York areas, write today, including a resume of your education and experience. Address Mr. G. D. Bradley

THE GARRETT CORPORATION
9851 So. Sepulveda Blvd.
Los Angeles 45, Calif.

DIVISIONS
AiResearch Manufacturing, Los Angeles
AiResearch Manufacturing, Phoenix
AiResearch Industrial
Rex — Aero Engineering
Airsupply — Air Cruisers
AiResearch Aviation Service

AiResearch MISSILE AUXILIARY POWER UNIT

Compact, reliable system features high output with simplicity of design

SPECIFICATIONS:

Output: 650 watts, 5000 cycles, 115 volts, single phase
35 watts, 400 cycles, 115 volts, single phase
0.6 gal. per min. at 2000 psi hydraulic pressure

Regulation: ± 5% voltage and frequency

Duration:	27 seconds
Weight:	9.5 pounds
Size:	6.14 in. diam., 6.74 in. long

Ground power: compressed air

This AiResearch auxiliary power package operates the vital electrical and hydraulic systems in a missile.

Gases from a solid propellant spin the unit's turbine wheel at 50,000 rpm. The turbine's shaft drives the following: a 650 watt generator which supplies electrical power to run the missile's guidance system; a 35 watt generator which runs the missile's gyros; a hydraulic pump which in turn powers the servos that control the movable flight surfaces of the missile's airframe.

The hydraulic system features drilled passages which eliminate the need for potentially troublesome plumbing. It includes reservoir, filters, temperature compensator, relief valve, check valve, and squib valve within a single housing.

This auxiliary power system is an example of AiResearch capability in the missile field. Inquiries are invited regarding missile components and sub-systems relating to air data, heat transfer, electro-mechanical, auxiliary power, valves, controls and instruments.

Outstanding opportunities for qualified engineers

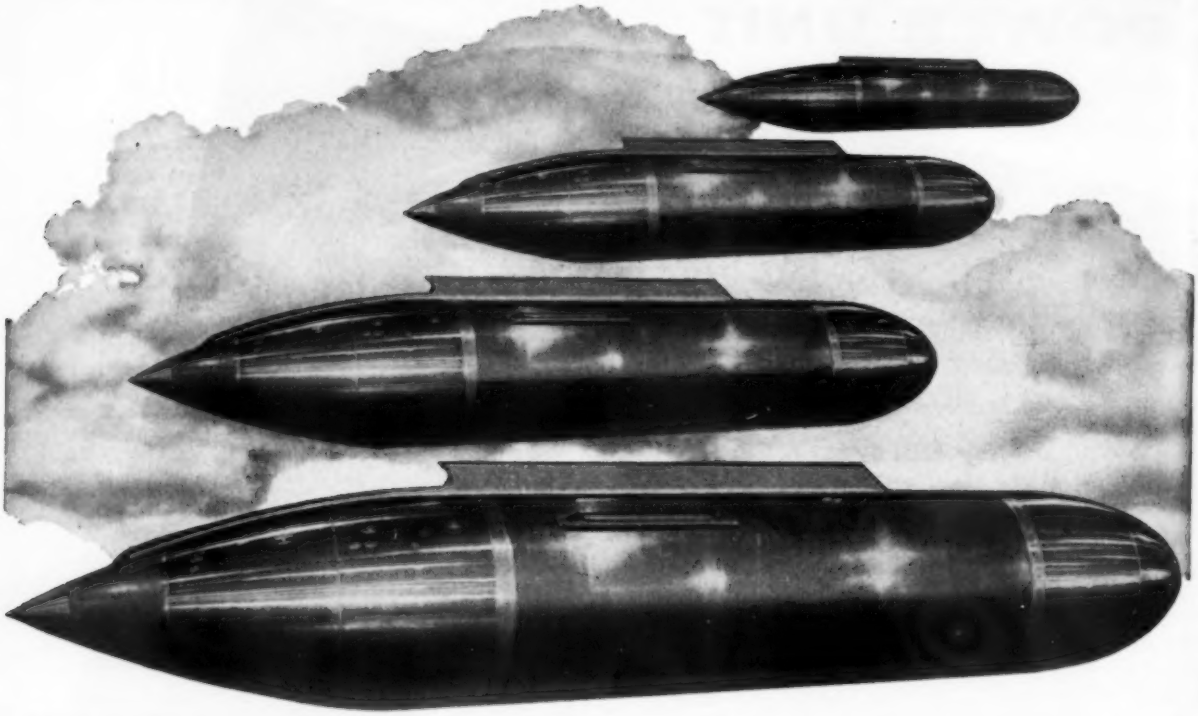
THE GARRETT CORPORATION

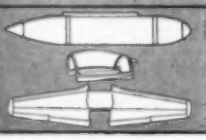
AiResearch Manufacturing Divisions

Los Angeles 45, California . . . Phoenix, Arizona

Designers and manufacturers of aircraft and missile systems and components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

CAPABILITIES . . . Manpower, Tools and Experience



BEECH BUILDS	
	MA-3 MULTI-PURPOSE VEHICLES
	C-26, MD-3 POWER UNITS
	8-PLACE BEECHCRAFT SUPER 18
	6-PLACE BEECHCRAFT TWIN-BONANZA
	4-PLACE BEECHCRAFT BONANZA
	BEECHCRAFT T-34 TRAINERS
	BEECHCRAFT L-23 TRANSPORTS
	TANK-WING-MAJOR SUBASSEMBLY SUBCONTRACT PRODUCTION

The 1700-gallon jettisonable fuel tank for the Boeing B-47 "Stratojet" is only one of the many designs manufactured on Beechcraft's versatile production lines. During the Korean War, for example, Beech Aircraft Corporation manufactured 20 different types of aircraft tanks and fire bombs, establishing a production record of 400 tanks a day and delivering a total of more than 150,000 tanks to the U. S. Armed Forces.

In addition to the 1700-gallon "Stratojet" tanks, Beechcraft's "tank line" is now producing 1400-gallon tanks for Lockheed's G-130 "Hercules" . . . 282-gallon tanks for McDonnell's F3H-2N "Demon" . . . and 230-gallon and 450-gallon tanks for Republic's F-84F "Thunderstreak" and RF-84F "Thunderflash." Beechcraft's Research & Development Laboratories are busy, too, with classified projects for new aircraft tanks and refueling equipment.

Beech Aircraft Corporation has five major plants with 1¾-million square feet of plant area and 7,000 skilled employees . . . *with capabilities.* Beechcraft's manpower, tools and experience can be put to work to solve research, development or production problems. Whatever your needs, telephone or write Beechcraft's Contract Administration Division today.

Beechcraft

BEECH AIRCRAFT CORPORATION, WICHITA, KANSAS, U. S. A.

Copter Service Firms Expand Operations In Oil Survey Work, Many Other Fields

The versatility of the helicopter for military operations is well known, but it is the civilian who is most ingeniously adapting the copter's capabilities into lucrative private enterprise projects.

Although still relatively few in number, helicopter service companies are flourishing. Operations are diversified throughout agriculture, patrol, surveying, mapping, rescue—with more than 100 uses estimated outside of pure transportation.

Two pioneer companies are Hawk Helicopters of Fort Worth and Petroleum Bell Helicopter Services of Lafayette, La. The two firms have just two common denominators: (1) both are helicopter operators and (2) both engage in oil exploration work. But from this base, they break into two extremes with Hawk deep in diversification and Petroleum Bell hewing to the pure definition of specialization.

Petroleum Bell Service, organized in 1949, has made a science and a commercial business out of the use of the helicopter in the complex oil exploration field. With a copter fleet of 24 Bells, six Sikorsky S-55s and a Sikorsky S-58, the company's 110 employes provide the oil industry with every possible phase of petroleum exploratory work by helicopter.

R & D Business Important

Research and development of methods and equipment have become an integral part of the helicopter oil service business. Examples:

• Seismograph operations by helicopters demanded redevelopment of survey towers for transit men, cargo gondolas for drilling and recording equipment, and methods for laying geophone cable in a straight line. Months of collaboration between the seismograph and helicopter operators yielded a lightweight collapsible aluminum survey tower that can be easily transported by helicopter and quickly erected.

A small, compact aluminum tub or gondola was designed—and is still in use—to allow the towing of stainless steel geophone cable by copter. The geophone cable was radically redesigned to make it strong enough to tow through the marsh but small enough so it could be reeled from the cockpit of the helicopter.

• Gravity meter reconnaissance, a major activity in oil exploration, was not as difficult to adapt to the helicopter, since the meter is usually portable enough to be transported by air anyway.

But a new problem presented itself in the necessity for protecting the meter from the wind and keeping it on as firm foundation as possible. Petroleum Bell solved this by installing a tripod in the floor of the helicopter so as to allow it, upon landing, to be ejected through the floor and pushed into the ground.

The company also has solved problems of scintillometer, magnetometer and surface geology for the helicopter age. Operations first begun in the Louisiana marshlands have now extended out to other states and into Canada, Guatemala, Panama, Colombia, Venezuela and Ecuador.

• Supreme Court decision giving the Tidelands to Louisiana and Texas brought a new form of business for the company. Offshore drilling sites spelled transportation of personnel, more than materials, to Petroleum Bell. Initially, it was a selling job to the oil companies, with the commodity mass transportation of men. The first S-55 was acquired in January, 1954, and was under contract three months later.

"In the beginning," Frank Lee, vice president, said "the helicopter certainly didn't reflect a savings in money to the client. However, as it was utilized more and more, it finally paid its own way and from that time on greater utility meant increased savings."

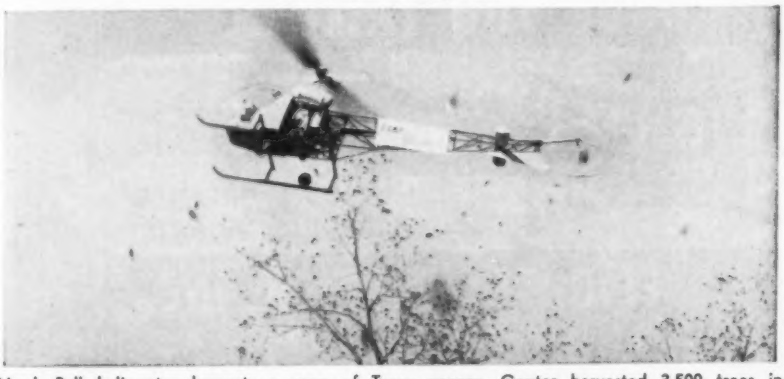
The six S-55s are in such service but the company has found that as drilling operations extend farther out from the coast, weight limitation creates a great problem. Drastic reduction in payload has occurred, Lee said, in order to increase fuel for the round-trip.

Hawk Expanding

Hawk, too, is engaged in oil survey work and is expanding into Canada, Central and South America. While representing 50% of sales, it is just one of dozens of services provided by the company's four Bell 47Gs and two 47G2s (with a Bell 47J on order).

Organized in November, 1954, Hawk is headed by Frank H. (Bud)

Anything man can do with small boats and trucks, he can do with helicopters. Petroleum Bell Helicopter Service gets ready to land workers on a Tidelands off-shore drilling site in one of its Sikorsky S-55s.



Hawk Bell helicopter harvests a crop of Texas pecans. Copter harvested 2,500 trees in one week. It would have taken tractor three months.

Kelley, former test pilot for Chance Vought and Bell. His staff of 25, including pilots and mechanics, have helicoptered their way to Canada's DEW line, political campaigns, coyote hunts, fence patrols and pecan harvesting. Some examples:

• Hawk copters last summer conducted the largest single aerial uranium survey ever made, covering 175,000 acres in a 47G in three months for a subsidiary of American Cyanamid and Pittsburgh Plate Glass.

• Ambulance service via the "egg beater" has been provided on numerous occasions. One situation called for bringing several seriously injured men from an offshore drilling site to the hospital quickly. The copter delivered the litters from the Gulf of Mexico to the hospital in 30 minutes.

• Radiometric surveys have been conducted under contract from Southern Minerals in Texas and for New Jersey Zing in North Carolina.

• Frost control has been provided by having a copter patrol over crops during heavy frost at night. The rotor blasts warm upper layers of air downward.

'Helitaxis' in Operation

Other services provided have included "helitaxi" transportation for executives in a hurry from airport to industrial sites and transportation for politicians on the stump, including Arkansas Sen. John McClellan and Colorado's Governor Edwin Johnson. Rescue mission was performed several years ago when 300 train passengers were stranded after a wreck was caused by a flood.

Commercial fishing boats have pressed Hawk Helicopters into service. The crews fly ahead, spot large schools of fish and send signals back to the fishing fleets.

Helicopters were used most recently to harvest a 2,500-tree orchard of pecans. As a pecan flailer, the helicopter harvested the 2,500 trees in one week. It would have taken a tractor three months. The downwash of the rotors succeeded in loosening the pecans' green hulls and the pecans safely fell to the ground. ◈ ◈ ◈

New Low-Cost Champion Tri-Traveler

Tri-cycle landing gear version of Champion Traveler has been announced. Built by Champion Aircraft of Osceola, Wisc., new low-cost plane is called the Tri-Traveler. It's powered by a 95-hp Continental engine. Standard equipment includes padded and equipped instrument panel, all-metal prop, landing and navigation lights, 26-gallon wing tanks, other features. Floats and skis are available as optional equipment.

Business Flying Briefs

• **Atlantic Aviation** companies have been consolidated into a single corporation, called Atlantic Aviation Corp. Company changes include: Atlantic Aviation Service, Inc., to the Wilmington, Philadelphia and Lynchburg divisions; and Atlantic Aviation, Inc. to New York and Boston divisions. Move was designed to integrate operations for greater efficiency and increased service.

• **"Up High,"** by Bill Mauldin, is a new promotion piece for Piper Aircraft. The booklet, cartoon-illustrated, not only presents Mauldin's endorsement of the Piper Tri-Pacer but is a refreshingly written story on private flying in general from the pilot's point of view.

Aviation Honors

Arthur R. Christie, Washington representative for Pratt & Whitney Aircraft, elected president of the Aero Club of Washington, succeeding **Frederick B. Lee.**

Charles H. Godschall, mgr. of tooling for the Government and Industrial Div. of Philco Corp., received Distinguished Service Award from the Navy for his work as a consultant to the Bureau of Ordnance in the development of a "new and advanced anti-submarine weapon."

Ross Fleisig of Sperry Gyroscope Div. of Sperry-Rand Corp., elected president of the American Astronautical Society; **James H. Rosenquist,** RCA Communications, Inc., named admin. vp.

Roy E. Marquardt, president of Marquardt Aircraft Co., elected a vp of the Institute of the Aeronautical Sciences.

Milton Caniff, creator of the Steve Canyon cartoon strip, received the Exceptional Service Award, the Air Force's highest civilian award, in recognition of his "20 years of service to the Air Force." He was cited for his "intense interest and knowledge" of AF activities and for his contribution to the "morale and efficiency" of all airmen.

HONOR ROLL

(For 25 years' or more service in the industry)

★**B. R. Freakley,** Convair. Dept. 258, San Diego, Calif. (30 yrs.)

Harry Fortier, Pratt & Whitney Aircraft. Carburetor air box tester, E. Hartford, Conn.

Edward Smith, Pratt & Whitney Aircraft. Gear machine operator, E. Hartford, Conn.

A. E. Rominger, Convair. Dept. 31, San Diego, Calif.

H. D. Ford, American Airlines. Dist. sales mgr., Washington, D.C.

O. A. Tucker, American Airlines. Lead mechanic, Dallas, Tex.

W. C. Grasel, American Airlines. Foreman, radio overhaul, flight. LaGuardia Field.

C. F. Gnauck, American Airlines. Chief, A/C ramp service, El Paso, Tex.

L. A. Lang, American Airlines. Manager, machine accounting, New York City.

A. Stehno, American Airlines. Foreman, maintenance, Los Angeles, Calif.

HAVE YOU TRIED...

FLIGHTEX GLASS CLOTH

FLIGHTEX FABRIC

WORLD'S PREMIER AIRPLANE FABRIC

FLIGHTEX FABRICS, INC.

93 Worth Street • New York 13, N. Y.

Leading Manufacturers of Fabrics and Tapes for the Aircraft Industry

Circle No. 42 on Reader Service Card.

ALL ROADWAYS LEAD TO

babb SERVICE!

- **PARTS**
- **OVERHAUL**
  - ENGINE
  - PROPELLER
  - ACCESSORY
  - INSTRUMENT
  - RADIO
  - AIRFRAME
- **AIRFRAME SPARES**
- **AIRCRAFT SALES**

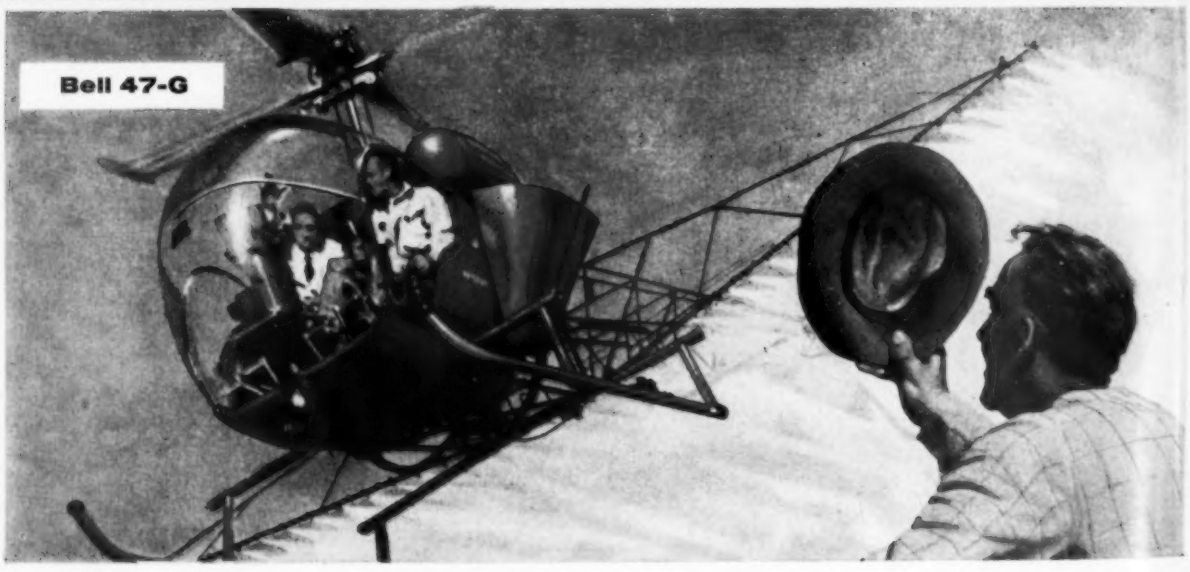
Write today for your copy of Babb's facility brochure.

THE **BABB** COMPANY, INC.

Sky Harbor Airport, Phoenix, Arizona

Linden, New Jersey; St. Johns, Quebec, Canada;
Glendale, Calif.; Miami, Fla.; London, England; Paris, France;
Brussels, Belgium; Zurich, Switzerland; Rome, Italy; Damascus, Syria.

"MORE THAN 36 YEARS OF SERVICE TO THE AIRCRAFT INDUSTRY"



Birds of a feather with one thing in common . . . the dependable flow of power through SPECO Transmissions . . . engineered and built by the SPECO Aviation Division of the Kelsey-Hayes Company, Detroit 32, Michigan.

KELSEY HAYES

Major Supplier to the Automotive, Aviation and Agricultural Industries

*15 PLANTS / **Automotive:** Detroit and Jackson, Michigan; McKeesport, Pa.; Los Angeles, Calif.; Windsor, Ontario, Canada **Aviation:** Jackson, Michigan; Springfield, Ohio — 2 plants — (SPECO Aviation Division); Utica, New York — 4 plants — (Utica Drop Forge and Tool Division) • **Agricultural:** Davenport, Iowa (French & Hecht Farm Implement and Wheel Division)*

Circle No. 26 on Reader Service Card.

International Aviation

By Anthony Vandyk

On March 1 Ouest Aviation merges with Sud-Est Aviation to become Sud Aviation. The new French company will be, in terms of manpower, the dominant aircraft manufacturer in Europe. It will produce models in almost every category from the 1,700-lb. Djinn helicopter to the 90,000-lb. Caravelle transport. And it will have license tie-ins with three leading U.S. manufacturers—Republic, Sikorsky and Vertol—as well as with Britain's de Havilland Aircraft Company.

In the past Ouest Aviation and Sud-Est Aviation have been leaders in calling for a united European aircraft industry. Georges Hereil, dynamic head of Sud-Est who will be in charge of Sud Aviation, has played a key role in the affairs of the continental European aircraft manufacturers' association, AICMA. He was also instrumental in bringing about an unusual arrangement between Sud-Est and Italy's Fiat company whereby the two manufacturers helped each other in supplying components for the de Havilland fighters which both were building under license.

• **Georges Glasser,** head of Ouest Aviation and No. 2 man in Sud Aviation, is as much of an internationalist as Hereil. He has arranged for Belgium's Sabca company to help Ouest Aviation in building components for the Vautour fighter/bomber.

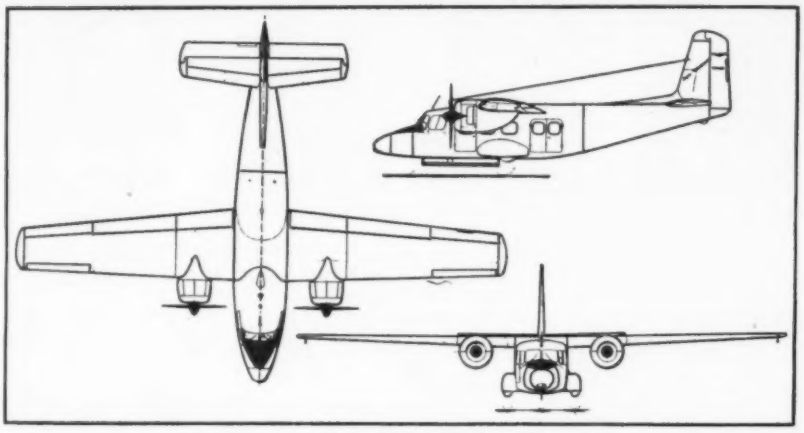
But the greatest achievement of the French aircraft industry's leaders in the field of international cooperation has been to win the German market. Two of France's most important aircraft—the Nord 2501 Noratlas transport and the Fouga 170 Magister jet trainer—are to be built under license in Germany in large quantities. Moreover, the Germans are buying small quantities of each model from the French companies to equip the new Luftwaffe before the German-built models come off the line.

• **The success** of Hereil, Glasser and the other top men in winning the German contracts from France's traditional enemy and competitor is no mean achievement, particularly as it was obtained in the face of the stiffest competition from other nations' aircraft industries.

One reason for the French success in wooing the Germans was the complete frankness and friendliness which has been shown to the aircraft industrialists and military officials of West Germany. France told Germany, in effect, "Everything we have is yours—know-how, research facilities, licenses."

By having Germany as an ally instead of an enemy, the French aircraft industry undoubtedly hopes that it will be able to work with the Germans on joint projects that are too big for the resources of either country. Other continental European nations will be able to participate in such programs which many observers feel represent the only way that the European industry can continue to compete with the United States.

French Firm to Build New Transport



Cutaway views of Max Holste 350 Super Broussard

A new French transport, competitive in many respects to the Scottish Aviation Twin Pioneer, is being built by the Max Holste Co. Known as the MH 350 Super Broussard, the new aircraft, illustrated on this page, will be powered by two 600-hp P&W R-1340s.

An alternate version with Turbomeca turboprops is also projected. Furthermore, operators who buy the piston engine-version will be able to re-engine with turboprops without difficulty.

The first Super Broussard prototype is scheduled to fly late in 1958 or early in 1959. Construction of the aircraft started recently at Max Holste's Rheims plant where the main activity is production of the single-engine Broussard utility transport. The company has orders for 400 Broussards. Production is being stepped up to 12 aircraft a month early this year.

The Super Broussard is designed to carry 14 to 16 passengers. Specifications for the aircraft follow: span, 69 ft. 1 in.; length, 51 ft. 7 in.; empty weight (equipped), 8,818 lbs.; gross weight, 13,800 lbs.; max. speed (with R-1340), 225 mph; max. cruising speed, 206 mph; economical cruising speed, 183 mph; takeoff run at full weight to clear a 50-ft. obstacle, 869 ft. (or 1,050 ft. to meet ICAO requirements); landing distance, 1,312 ft. (ICAO, 1,772 ft.); range (normal), 685 miles; range (maximum), 1,305 miles.

U.S., U.K. Requirements Conflict—de Havilland

Some requirements of the British Air Registration Board and the U.S. Civil Aeronautics Administration are conflicting, according to the de Havilland Aircraft Co.

Discussing the certification program for the Comet 4, the British jet transport manufacturer reports that "the technical and engineering requirements of the ARB have been met, and the CAA requirements, such of them as have been finalized, appear to present no insurmountable problems."

In a progress report on the Comet 4 de Havilland discloses that the "Q-feel" element for elevator control and additional safety features have now been incorporated in the aircraft's control system. The de-icing system has been extensively developed and now complies fully with "the most severe certification requirements." A new cabin air recirculating system has been evolved.

Two extended levers are being fitted in the modified control pedestal of the Comet 3 development aircraft in readiness for the reverse thrust system that is to be used on the Avon engines. The Comet development program has resulted in much work to make the Comet 4A, the version to be operated by Capital Airlines, independent of ground equipment at intermediate traffic stops.

An auxiliary power unit will be incorporated to supply self-contained power for engine starting and ancillary services. This will also be capable of operating the refrigerated air-conditioning system on the ground. Folding access stairs are to be built into the cabin entrance.

TRANSPORT BRIEFS

Ethiopian Airlines is using part of a $24-million Export-Import Bank loan to buy two DC-6Bs. The loan is for the development of Ethiopian aviation . . . **Scandinavian Airlines System** will start operations to Prague and Warsaw in April . . . **Swissair** is operating a Twin Pioneer to link Zurich with the winter sports centers of Davos and St. Moritz. The STOL aircraft also connects Zurich with La Chaux de Fonds and Geneva.

MANUFACTURING BRIEFS

Fokker Aircraft now has orders for 30 Dutch-built F-27 Friendships and options on 17 more . . . **F. G. Miles** is quoting $36,400 for the M.100 Student jet trainer. This price is based upon a production of 200 aircraft.

People

BEAN

KELLER

BUSTER

ROCKWELL

GIDEONSE

BARRETT

MANUFACTURING

Name	New Position	Former Position
Richard L. Bean	Public relations mgr., Lockheed's California Div.	News bureau mgr.
William R. Wilson	Director of market development, Lockheed Aircraft Corp.	Public relations mgr., Calif. Div.
Warren R. Hughes	News bureau mgr., Lockheed Calif. Div.	Mgr. foreign news bureau section
E. U. DaParma	VP-operations, Sperry Gyroscope Co.	VP-manufacturing
Douglas B. Nickerson	Chief engnr., Hydro-Aire, Inc.	Asst. chief engnr. for R & D
Richard M. Degen	Resigned	Chief engnr., Hydro-Aire, Inc.
Lt. Gen. L. C. Craigie (USAF, ret.)	Resigned	VP-engrg., Hydro-Aire, Inc.
Joseph E. Mayl	Retired	VP general products group, Goodyear Tire and Rubber Co.
Sam DuPree	VP general products group, Goodyear Tire and Rubber Co.	Gen. mgr., industrial products div.
Capt. F. D. Pfotenhauer	VP-production, Reaction Motors, Inc.	Navy (Ret.)
D. C. Eaton	VP-program management, Reaction Motors, Inc.	Works mgr.
Richard S. Wolff	President, Camloc Fastener Corp.	Vice president
Russel J. Keller	Engrg. asst. to vp and gen. products group exec., American Machine & Foundry Co.	Dir. engrg., Cleveland welding div.
Ted W. Blaser	Mgr., electrical products sales, B. F. Goodrich Aviation Products div.	Sales engnr.
George A. Daum	Mgr. commercial sales div., Wright Aeronautical Div.	Sales engnr., Engineering Dept.
Edward Glodeck	Mgr., military relations div., Sales Dept., Wright Aeronautical Div.	Advisor to Asst. Sec'y of Defense
Donald J. Euler	Dir., operations planning, Boeing Airplane Co.	Asst. to sr. vp-operations planning
L. B. Ludford	Corporate facilities operations planning adminr., Boeing Airplane Co.	Transport div. controller
Ben M. Wheat	Transport div. controller, Boeing Airplane Co.	Controller, Wichita div.
Elmore P. Pillsbury	Chief engnr., Fairchild Guided Missiles Div.	Chief, aeromechanical engrg.
Tex S. Lines	Asst. mgr., Guided Missiles Div., Bell Aircraft Corp.	Chief, missiles dept.
John C. Parkin	Dir. engrg., Guided Missiles Div., Bell Aircraft Corp.	Asst. project mgr., Rascal missile program
Edmond B. Buster	VP and gen. mgr., Cherry Rivet Div., Townsend Co.	Sales mgr., S & C Electric Co.
James L. Murray	Admin. asst. to president, Republic Aviation Corp.	With Garrett Corp.
Charles S. Rockwell	VP and gen. mgr., Ford Instrument Co., div., Sperry Rand Corp.	VP and works mgr., Sperry Farragut Div.
Dr. Philip K. Porter	Head, Technical Services Dept., Cornell Aeronautical Laboratory, Inc.	Head, Materials Dept.
Dr. John L. Beal	Head, Materials Dept., Cornell Aeronautical Laboratory, Inc.	Asst. head, Materials Dept.
Verne W. Brown	Retired	Flight oper. mgr. and chief test pilot, Douglas Aircraft Co.
Charles H. Hanson	Advertising mgr., The Garrett Corp.	Supervisor of publications
Raymond A. Ballweg, Jr.	Spec. asst. to board chmn. and president, Hycon Mfg. Co.	In office of AF Secretary
V. L. Gaston	Mgr., Super 18 sales, Beech Aircraft Corp.	Regional sales mgr.
Raymond J. Condon	VP, Aeronautical Div., Minneapolis-Honeywell	Mgr. military sales
R. Deane Aylesworth	Corporate adv. mgr., North American Aviation	Adv. mgr., Hoffman Laboratories
Harry Tibbet	Gen. offices services mgr., North American Aviation	Corporate adv. mgr.
Samuel Agabian	Mgr., Air Armament Div., Sperry Gyroscope Co.	Works mgr.
Myron D. Lockwood	Mgr., Surface Armament Div., Sperry Gyroscope Co.	Engrg. dir. of surface systems
Harry M. St. John	Mgr. sales, Sundstrand Aviation—Denver	With Hamilton Standard
James L. Murray	Adm. asst. to the president, Republic Aviation Corp.	Asst. to president, The Garrett Corp.
Henry Grady Beaird, Jr.	Chief exper. test pilot, Republic Aviation Corp.	Test pilot
Francis J. Wiegand	Engrg. admr., Wright Aeronautical Div.	Asst. chief engnr. for controls

AIRLINE

Dirk J. Koeleman	VP and gen. mgr., USA, KLM Royal Dutch Airlines	Gen. mgr., USA
Paul A. Gideonse	VP-sales, USA, KLM Royal Dutch Airlines	Sales dept., Holland
Edward R. de Vries	VP-finance, USA, KLM Royal Dutch Airlines	Finance mgr., USA
D. B. Wright	Sales and oper. mgr., Seaboard & Western Airlines for the United Kingdom	Cargo sales mgr. for TWA in London
Rodney W. King	Exec. vp, Riddle Airlines	Diebold, Inc.
Peter T. Craven	Sr. vp and treas., Riddle Airlines	Exec. VP-Treasurer
G. H. W. Wharton	Passenger sales mgr., British European Airways	Sales mgr. North America
John F. Norton	Sales mgr. for North America, British European Airways	Asst. sales mgr., London
Leonard K. Thomson	Resigned	Dir., Dade County Port Authority
James F. Byrne	Mgr., Logan International Airport, East Boston, Mass.	Acting mgr.
John R. Carver	VP-community and press functions, Mohawk Airlines	Vice president
Robert T. Sidney	Dir. community affairs, Mohawk Airlines	Asst. to president
Leo E. Murphy	Dir. press relations, Mohawk Airlines	Dir. public relations
Bruce C. McLean	Dir. legal affairs, Mohawk Airlines	Asst. sec'y
Lee W. Holmes, Jr.	General traffic mgr., Mohawk Airlines	Superintendent of Stations
Nicholas Detiere	Sec'y European Civil Aviation Conference	Sabena Belgian World Airlines' exec. staff
Stanley G. Markusen	Resigned	Dir. public relations, U.S. office, Sabena
O. Roland Frost, Jr.	Dir. of property leases, Braniff Airways	Mgr., Braniff Airways, Sao Paulo, Brazil
Dennis Stepan	Sales mgr., Caribbean and Central America, for Lufthansa	Importing and exporting, Latin America
John F. Barrett	Dir. traffic and sales, Riddle Airlines	Gen. traffic mgr.
Eugene C. Taylor	VP-maint. and engrg., American Airlines	In chg. overhaul base, Tulsa

GOVERNMENT

Perkins McGuire	Asst. Defense Sec'y for Supply and Logistics	Deputy for Military Assistance Programs
Thomas Pike	Spec. asst. to Defense Sec'y Wilson	Asst. Defense Sec'y for Supply and Logistics
Maj. Gen. Frederic Glantzberg	Chmn. single manager airlift committee	Commander, USAFE's 17th Air Force
Stafford Kernan	Retired	Chief, statistical operations sect., CAA

American Airlines test pilots Ken Herschel (*left*) and Dick Green (*right*) tell Fisher about the program of an impending flight test

One of a series on the care taken by leading airlines to keep their planes fit for flight—and why this care has led them to select CHAMPION SPARK PLUGS. First—American Airlines and a look at . . .

C.A.V.* at Tulsa

By **HERB FISHER**

**Continuous Airworthiness Visit*

HERB FISHER,
international aviation authority, veteran test pilot, and author

RECENTLY I was a much impressed visitor to the vast American Airlines Overhaul and Supply Depot at Tulsa, Oklahoma, where the world's largest airline fleet operating from a single maintenance base is kept in top flight order. Each of American's 200 planes comes to Tulsa at least six times every year—1,200 aircraft visits in 12 months—more than 1,500 engines completely rebuilt. In the shop, and outside on the flight line, nearly 4,000 skilled employees do the huge maintenance job needed to "keep 'em flying."

Tulsa has the dual functions of preventive maintenance and progressive overhaul. Both have the single objective of finding and correcting trouble before it starts, and before an airplane is "out of hours" and ineligible to carry passengers. American predicts, with amazing accuracy, the working life of almost every piece of equipment. This makes the job of the maintenance department clear, if not easy. The department sets up its schedule so that it anticipates mechanical trouble and takes preventive action before it occurs.

A good example of American's preventive maintenance is the autopilots flown on American's aircraft. Autopilot system components have a CAA authorized overhaul period of 5,000 hours. American pulls them at 2,500 hours —an admirable illustration of the lengths to which the airline will go to insure safety and reliability.

C.A.V. — Schedule for Airworthiness

Progressive overhaul is American's other maintenance must. Operating on a regular schedule, every aircraft in American's fleet visits Tulsa for its C.A.V.—Continuous Airworthiness Visit. About ten days are required per visit, during which time AA's inspectors and mechanics will perform an average of 5,400 different jobs on each aircraft, taking thousands of man-hours. Nothing is overlooked.

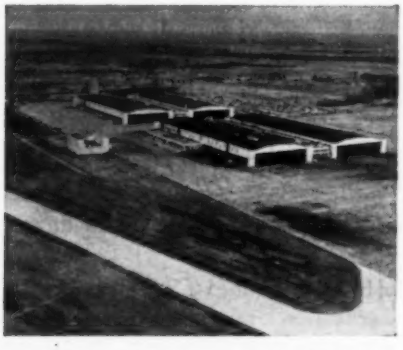
When a plane arrives in Tulsa for its C.A.V., inspectors are assigned to go over the entire airplane, checking its structure, functional systems, appearance, etc., using special test equipment. In ten days the plane leaves Tulsa "newer than new," but just a little more than 2,000 hours away from its next visit.

Using this technique, American has never had to take an airplane completely apart. These trips to Tulsa do the "out of hours" overhaul job progressively—and do it better.

Champions Proven on Engine Line

I was especially interested in the engine line, where every single piece of the big Pratt & Whitney and Curtiss-Wright turbo-compound power plants gets a meticulous inspection. I saw the typical overhaul for engines, running from

American Airlines technicians put rebuilt engine through its paces in test cell before running flight tests on it.



These four hangars—center of American's maintenance operation—contain 15 acres of floor space, handle 1,200 aircraft overhaul visits a year.

Transferring Champ Spark Plugs from orig carton into Americ engine-set box for s ment to line stat Champion's consist high quality makes possible without fur inspection.

C.A.V. at Tulsa . . .

a special report for Champion Spark Plug Company

Top American Airlines executives at Tulsa tell Fisher of Champion's highly satisfactory performance. *Left to right:* E. O. Schroeder, Assistant Vice President, Quality Control Division; Fisher; J. B. Montgomery, Vice President, whose duties include supervision of the Tulsa base; W. C. Lawrence, Assistant Vice President, Engineering Division; and D. F. O'Donoghue, Assistant Vice President, Overhaul Division.

dismount and disassembly through cleaning, parts inspection, rework where needed, reassembly and testing.

It was during parts inspection, which includes tests on spark plugs and other engine components, that American began telling me about the splendid record of reliability, service, and economy of Champion Spark Plugs.

W. C. Lawrence, Assistant Vice President—Engineering, said that the whole area of ignition—spark plugs, magnetos and leads—has been the No. 1 cause of mechanical delays during the last 21 years. It is for this reason, he told me, that American particularly likes Champion's dependability and economy.

"American's philosophy is to search constantly for the most reliable ignition components available," said Lawrence. "We want simplicity, reliability, and ease of maintenance, and Champion has proven over the years to give it."

T. J. Harris, Director of Power Plant Engineering, stated that he admires Champion's research and development program, and their desire to define and resolve ignition and spark plug problems. He feels that Champion has made a notable contribution to American's operation.

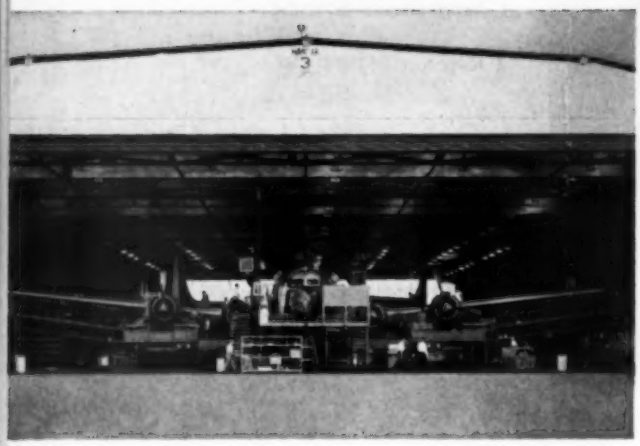
Demand Quality with Economy

E. O. Schroeder, Assistant Vice President of Quality Control Division, told me about AA's experience with Champion economy. "For years the airlines have had to concentrate on obtaining the best possible parts and accessories that would cause the least trouble. But now we are at a stage where aviation has turned into big

Champion Aviation Representative Russ Biegel monitors line service spark plug installation as part of service coverage. Technical information gained is available to all Champion users.

The engine line produces 1500 "new" engines a year. After four hours in test cells, running at all speeds, engines are flight tested by engineering test pilots for another four hours.

D. E. Tait (*left*), Director of Supply, had favorable comments on Champion's service, economy and availability. T. B. Robertson (*center*), Manager of Purchasing; (*right*), T. J. Harris, Director of Power Plant Engineering.



During a C.A.V., the interior is completely disassembled, freshened, and rebuilt where needed. All structure is completely inspected and components are replaced as required. Even X-ray is used for checking critical areas.

Removing spark plugs from engine for careful testing. Rigorous inspection over the years has kept American convinced of Champion's dependability.

business. As a result, without any slacking of quality, people in the aviation field must be concerned with price as well—and Champion has been a leader in reducing spark plug prices.

"Spark plugs are a major expenditure with us, and we consider ourselves fortunate to be able to get a quality product for the lowest price consistent with reliability and performance."

10,000 Hours on Champions

Another American man that I later talked to at New York International Airport was Captain S. P. Bittner, who started flying September 14, 1924, and has accumulated 30,000 flying hours. He has been flying for American since 1929. Since Champions have been used for 10 years, Capt. Bittner has flown approximately 10,000 hours with Champion Spark Plugs, or roughly 40,000 engine hours. Capt. Bittner stated that after flying for 10 years with Champions he has never encountered true plug trouble.

The final word on Champions came from J. B. Montgomery, American Vice President—Maintenance and Engineering. "These plugs give us the high, consistent quality we need to assure long life and trouble-free operation," Montgomery declared. "We also like Champion's realistic price structure and the fine factory and field service they give us.

"Champion has built excellent spark plugs over the years for American Airlines. If they were not a quality product, they would not be on our engines."

The Champion people feel that American's experience speaks for itself in indicating to *all* pilots the superior performance and reliability of Champions.

—HERBERT O. FISHER

If you have the responsibility of selecting aircraft spark plugs, consider the fact that American Airlines . . . with millions of engine-hours experience as a guide . . . chooses CHAMPION SPARK PLUGS

Capt. S. P. Bittner, American pilot since 1929, tells Fisher he has flown 40,000 engine hours on Champions without encountering true plug trouble. Capt. Bittner flies the non-stop flight between New York and Los Angeles.

CHAMPION SPARK PLUG COMPANY • TOLEDO 1, OHIO

TRANSPORT TRENDS

Washington, D. C., Feb. 11, 1957

DOMESTIC TRUNKLINES' 1956 PROFIT after taxes didn't come up to 1955 total. This statement is being made by economists even though final figures for last year aren't in yet. They caution, of course, that year-end financial adjustments that carriers sometimes make might possibly change the result. But a big fourth quarter—$15.2 million net—was needed to reach 1955's $63.1 million profit (Transport Trends, Dec. 3). At least two factors were working against this: (1) expenses in last three months continued to climb faster than revenues; (2) bad weather affected operations.

It's pointed out that at the end of the first three quarters of 1956, trunks' operating income before taxes was some $9 million behind 1955. And if fourth-quarter operating income bore the same relation to the third quarter as it did in 1955, industry stood to be $12 million worse off by year-end.

•

TIGHTER GOVERNMENT SUPERVISION of U.S. airlines will result from continued expansion of CAB's audit bureau. Board auditors previously concentrated primarily on accounting of subsidized lines. They're now gearing to review such things as management policies, business practices and internal controls of both subsidized and non-subsidized carriers. Pushing hard for the stepped-up program is General Accounting Office, which has been openly critical of past CAB auditing practices.

•

CAB WILL PROBABLY be a four-man agency through February and part of March. Reason: delay in formal nomination of Louis J. Hector by the White House. President Eisenhower has announced his intention to nominate Hector to fill the post vacated by Joseph P. Adams last Dec. 31. But the routine security check made on all such federal appointees is expected to consume several more weeks. And after Hector is cleared and nominated, Senate confirmation may take one or two weeks.

•

MARCH 31 IS DEADLINE for CAA to complete a "fact-finding" study on airways user charges. This is first step in Administration program to start charging for airways. Study will update a 1953 report to Congress. It will include installation and operating costs of new equipment, military use of airways compared with civil, present tax structure, etc.

Top policy makers in Commerce Dept. will coordinate the report with CAB, military, Budget Bureau and probably industry. Toughest job will be to come up with a figure on which to base a charge, after deducting military use, present taxes, etc.

Best estimate is that data on which to propose a charge to Congress won't be ready until very late in the present session. Legislators may not be able to consider it until next year's session.

•

SALES PRICE of its F-27 Friendship turboprop transport has been raised $50,000 to $590,000 by Fairchild Engine & Airplane Corp. Increase is effective Feb. 15. Company has 44 firm orders plus 29 options (see page 48). Break-even point is estimated at about 80 planes.

MERCURY LUXURY

now available in 12 major cities

Mercury
AMERICAN AIRLINES

American Airline's famous Mercury service, formerly available only on New York-Los Angeles nonstop flights, is now extended to include all the cities listed above. Mercury luxury means red carpet service at shipside, reserved seats, superb cuisine—all on the DC•7, world's fastest airliner—and all at no extra fare.

AA **AMERICAN AIRLINES**

America's Leading Airline

Political Pressures Make Life Difficult for CAB

Senator Smathers' intervention in safety case involving Peninsular Air Transport latest in series of incidents; other cases recalled.

By WILLIAM V. HENZEY

Independent government agencies such as the Civil Aeronautics Board often leave much to be desired in fulfilling their quasi-judicial responsibilities but their job is being made harder, if not impossible, by some members of Congress.

By and large, Congress conducts itself admirably with respect to CAB, aiding at times, criticizing at others and passing needed legislation to modernize the 19-year-old agency. But recently the relationship has been subjected to individual instances of strain on the judicial status of the Board.

Last month, six CAB officials, including an examiner, were berated by a United States senator in the presence of a constituent whose firm received an adverse ruling from CAB. Almost simultaneously, another senator, first on his own and then employing the weight of a Senate Subcommittee, poked around publicly in a Federal Communications Commission case in which the record has been closed and a tentative decision made.

TV Application Involved

The FCC case is significant to aviation interests because it involves an application by an airline to own and operate a television station.

Involved in the first instance was Senator George A. Smathers (D-Fla.). During the week of January 14, he phoned CAB Chairman James R. Durfee for an explanation of the "procedures" involved in a safety case against Peninsular Air Transport, a non-scheduled airline charged with approximately 60 violations of CAB's safety rules.

• **CAB had unanimously** adopted the recommendation of Safety Examiner Joseph C. Caldwell, Jr. to revoke Peninsular's air carrier operating certificate, effective February 1. Durfee obliged Smathers by sending directly to the senator's office, the following, among others: Safety Examiner Caldwell, Opinion Writing Chief Joseph B. Goldman and Compliance Attorney Robert Burstein.

While the group was in Smather's office, the Florida Senator called in W. R. Robinson, president of Peninsular and a Florida resident and businessman. To the surprise of the three, Smathers wanted little fill-in on "procedures" but rather launched a critical attack on CAB policies, in general, and on some of the individuals.

It was not the first time Smathers had called in CAB officials about Peninsular which, in addition to the safety case, also stands to lose its economic authority for alleged violations of the Act and Board's regulations, and which was involved in a stormy hearing last year concerning an accident in Seattle in which 28 lives were lost.

It appeared at presstime that the senator's interference would have no effect on the outcome of the Peninsular safety case. But what indirect effect such tactics may have on other examiners and Board officials called on by law to rule in a case involving a Smather's constitutent is open to anyone's speculation.

• **In fairness to Smathers,** it should be pointed out that he proved a powerful friend of aviation only a year ago through his determined fight against the State Department on the subject of international air agreements. But he could undermine the prestige thereby gained by any repeats of last month's episode with the six CAB officials.

Curiously enough, the FCC episode involved one of Smathers' fellow members of the aviation subcommittee of the Senate Commerce Committee—Sen. A. S. Mike Monroney (D-Okla.). Monroney injected himself into a hot FCC case involving selection of an applicant to operate VHF television Channel 10 in Miami, Fla.

In mid-January, Monroney wrote FCC Chairman George C. McConnaughey asking for deferment of the case until the Aviation Subcommittee can look into the principle of an airline owning a television station. Significantly, the FCC had made a private decision favorable to National Airlines' wholly-owned subsidiary Public Service Television, Inc., but was awaiting completion of a formal written opinion before making its decision public.

There are three other applicants, none with airline connections, besides National's subsidiary. One of these three, a Miami Beach concern, had received a favorable Examiner's recommendation. Yet, Monroney's request for deferment was filed solely with relation to an airline owning a television station.

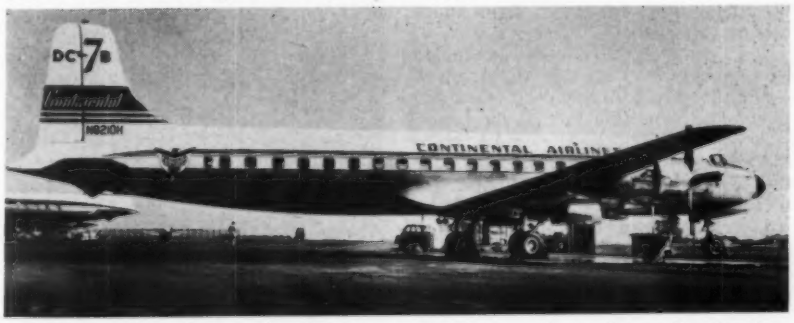
McConnaughey quickly turned down Monroney's request noting that the record was closed and that administrative procedure automatically rules out consideration of the Monroney request because it was not part of the record.

Undaunted, however, Monroney renewed his request January 23, this time with Senators Fred G. Payne (R-Me.) and Alan Bible (D-Nev.), members of the aviation subcommittee, also signing.

• **Monroney said** the subcommittee's interest was "specifically not in Channel 10, Miami." But he added, "it so happens that this specific case is the first time, to our knowledge, that the Federal Communications Commission has given serious consideration to establishing such a precedent" as an airline owning a television station.

There are no known grounds for questioning Monroney's motives in expressing the interest of his Subcommittee in matters affecting airline companies. But there appears to be a substantial question as to why the Subcommittee didn't pursue its inquiry to a conclusion before National's subsidiary incurred all the expense of prose-

DC-7B Destroyed in Test-Flight Collision



This is the Douglas DC-7B destroyed during a test flight in a mid-air collision with a Northrop F-89D over Pacoima, Calif. Plane, shown at time of roll-out, was to have been delivered to Continental Air Lines this month. CAL had planned to lease the transport to Delta Air Lines until Continental's new Los Angeles-Chicago operation becomes effective April 28. CAL will get two more DC-7Bs prior to the route opening.

cuting its FCC application. NAL's application was filed more than three years ago and there was ample opportunity for the Subcommittee and others to question it on the public record.

• **Last year,** numerous New England Senators proved trying on CAB's ability to keep a quasi-judicial status in the New York-Florida Case. In one instance, various Senators were critical on the Senate floor of a CAB Examiner who did not recommend in favor of a New England-based line for the coveted Florida route. Eventually, the report of the Examiner was reversed by CAB.

But there also was a bright note in Congressional aviation activities last month when Rep. Dante B. Fascell (D-Fla.) introduced a bill which included this provision with relation to proceedings before independent Federal agencies:

"It shall be improper conduct for any representative to . . . communicate or have any discussion with any agency, or with any employee or representative or official or presiding officer of any agency, concerning the merits or disposition of any contested adjudicatory proceeding before that agency, in the absence of or without reasonable notice to his adversary; or . . . attempt to sway the judgment of any agency, or of any employee or representative or official or presiding officer of any agency (1) by the use of threats, false accusations, or duress, or (2) by the offer of any special inducement or promise of advantage . . ."

The term "representative" as defined by Mr. Fascell's bill, which incidentally reflects an American Bar Association proposal for independent agencies, means "any person who acts, or holds himself out as acting or entitled to act, with or without compensation, in behalf of a participant in a matter before an agency." ◈◈◈

PAA Planning to Use Dural Props on B377s

Pan American World Airways is preparing to replace the Hamilton Standard hollow steel bladed propellers now used on its Boeing 377 Stratocruisers with Hamilton Standard solid dural bladed propellers.

Flight tests have been conducted with assistance of the Boeing Airplane Co. and Hamilton Standard. Completion of CAA certification of the installation is expected shortly. PAA plans the replacement for 26 B-377s on both the Pacific-Alaska and Atlantic divisions.

The new propellers are expected to provide better flight performance in all characteristics, including a gross weight increase approximately equal to the increased weight of the propellers.

An increase in the CAA-approved takeoff weight will necessitate an increase in the landing weight because of the fuel dumping requirements.

WAL Tries New Approach: Takes Tickets To Customers in Los Angeles Suburb

Panorama City is a typical new suburban shopping center in Los Angeles; 10 years ago a bean field, today a hub of retail markets, shops and stores, 25 miles from the city hall, 30 from the Los Angeles Airport.

Among the stores, one airline ticket office—Western Air Lines.

It's a new approach to ticket sales for WAL. You might call it the "retail" approach. In the first place, it is taking the tickets to the customers. It's in an area where women shoppers outnumber men manyfold. It's also a low-cost, small office, strictly functional, and a complete departure from WAL's previous rustic motif.

Fir Paneling Used

The architects selected to do this job, the Los Angeles firm of Burke, Kober & Nicolais, are specialists in retail design. By using wire-brushed Douglas fir for paneling and taking advantage of the structural brick wall as interior finished wall, plus generous use of light, cheerful colors, Burke, Kober & Nicolais, achieved the desired effect of modern design in dignified surroundings at a minimum of cost.

• **Office color scheme** of aqua and white is accented by touches of red and brown. The imported Danish furniture is brown with torch-light red fabric. Kerfs of aqua in the brown paneling blend with the aqua walls and ticket counters. Rubber tile flooring matches the aqua and makes a pleasant contrast with the wide grey stripes, which add to the illusion of width in the office.

Writing desks are placed to capture a feeling of living room comfort. This interior, including fixtures, floor coverings and other items, added up to only $10,000.

The office remains open only during regular retail store hours. Two agents staff it. This means that on two days a week only one agent is on duty. A district sales manager works out of the office.

Product identification is emphasized in the "retail" manner by keeping the offices and signs lighted at night. A large-size illuminated sign atop the roof of the one-story structure hits passing motorists right in the eye and also is visible from a long distance on the heavily traveled highway.

A sign in front beckons to pedestrians. The roof sign represents an advertising investment of $2,000, the sign in the front of the office $1,000.

If the Panorama City experiment works out as WAL anticipates, it plans to extend the idea to other shopping areas where the growth factor is high.

Facia of mosaic tile in subdued patterns gives texture to sign background and eliminates maintenance problem in this new Western Air Lines office in suburban Panorama City in Los Angeles. Pylon sign on top of building, not part of structure, may, if necessary, be removed.

Super B Engine Boosts C-46 Utilization

Pacific Airmotive's conversion of R2800-B credited with cutting costs of operation, maintenance and overhaul for Westair Transport fleet.

By FRED S. HUNTER

Temperature at the Alaska air field was 40 degrees below zero—so cold that aircraft engine oil dropped from the wing of the Westair Transport C-46 warming up for a DEW-line flight would have solidified before it touched the ground.

It would have been a demanding flight for any kind of aircraft, but the Westair pilot took off and climbed under maximum climb power for 32 minutes to get over the 16,000-foot mountains. Then he began his descent, landing at a point on the DEW line approximately 50 minutes later.

During the entire flight, the C-46 engines were operating either under full power, climb power or under an approach situation.

• **Westair Transport** has flown its C-46s more than 2,500 trouble-free hours (5,000 engine hours) in temperatures 40 below and colder since the first "Super B" engines developed by Pacific Airmotive Corp. were installed in the supplemental carrier's fleet of seven C-46s. Westair's president, R. S. Holbert, credits the successful operation of his planes during the past year primarily to conversion to the PAC engine.

One of Westair's interesting operations the last two years has been the moving of military household goods between Seattle and Anchorage, Fairbanks and Kodiak, Alaska, in conjunction with Lyon Van and Storage Co.

Operating Costs Cut

Holbert reports that Westair has logged 14,000 flying hours in its C-46s since converting to PAC's Super B engine. With no other modification to the aircraft, the carrier has increased daily utilization of each plane at least 10%. Decrease in cost per operating hour has amounted to $1.25 per engine hour while reduction in oil costs compared with the standard R2800-B engine has run more than 50%.

Holbert says Westair has cut departure and en route delays 25% through better reliability of the Super B engines.

Roy Backman, PAC vice president, says his company recognized the difficulties C-46 operators were experiencing with R2800-B engines back in 1953. Excessively high cylinder head temperatures resulted from the cowling and exhaust system design of the aircraft, causing failures in other parts of the engine and requiring excessive maintenance.

PAC assigned Ed Benkert, a veteran engine overhaul specialist, to the job of working out a solution of the problem. PAC agreed with other engine overhaul companies working on the problem that installation of R-2800-C cylinders into the -B engine was mandatory, but felt this was only part of the answer. It developed additional modifications to the diffuser section enhancing the distribution in the engine at the higher powers and incorporating revisions of manufacturer's service bulletins to make the Super B as modern as possible.

The -C cylinders reduced the cylinder head temperatures. Additional PAC modifications reduced between-overhaul maintenance costs and parts replacement costs.

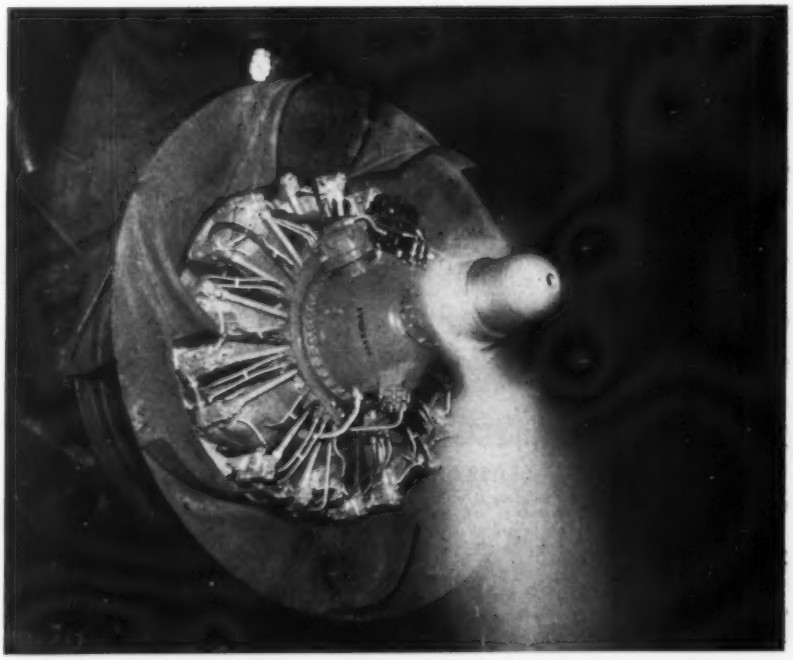
• **After months** of development, PAC was satisfied its engine filled all the requirements for airline operation and applied for and received CAA approval. It was added to the list of similar engines which have been designated by the CAA as the R2800-M1 series. PAC, however, elected to call its engine the R2800-Super B because it felt it was superior to any engine which could be built to the minimum R2800-M1 specifications.

Prior to offering the Super B to operators, PAC carried out a program of service testing under actual flight conditions in the belief that this was the only way to substantiate factually the performance of the engine.

The prototype Super B engine was installed on one of a C-46 operator's aircraft at no charge to the carrier. The engine was flown a total of 555.5 hours in routine operation and gave trouble-free service the entire time.

"Your Super B engine cut our operating costs $1.25 per engine hour," Westair president Bob Holbert (left) tells PAC Vice President Roy Backman.

Concurrently with PAC's testing program, the Aircraft Engineering Foundation, which had been formed by a group of C-46 operators to design modifications to enable the C-46 to meet T category requirements, became interested in the engine and expressed willingness to install it on their "Super 46" test airplane. This gave PAC the opportunity to test its engine in a redesigned power egg, with a



C cylinders and Scintilla magneto with pressurized cast ignition harness show clearly during Super B engine test in PAC's Burbank test facility.

standard R2800-B on the other side of the same airplane.

The prototype Super B with the 555.5 hours of operation still on it was removed from the fleet C-46 and installed on the Foundation's test Super 46. The only thing done to the engine at the change-over was to make a valve clearance check and install a torque nose so that accurate power readings could be made by the Foundation's engineers.

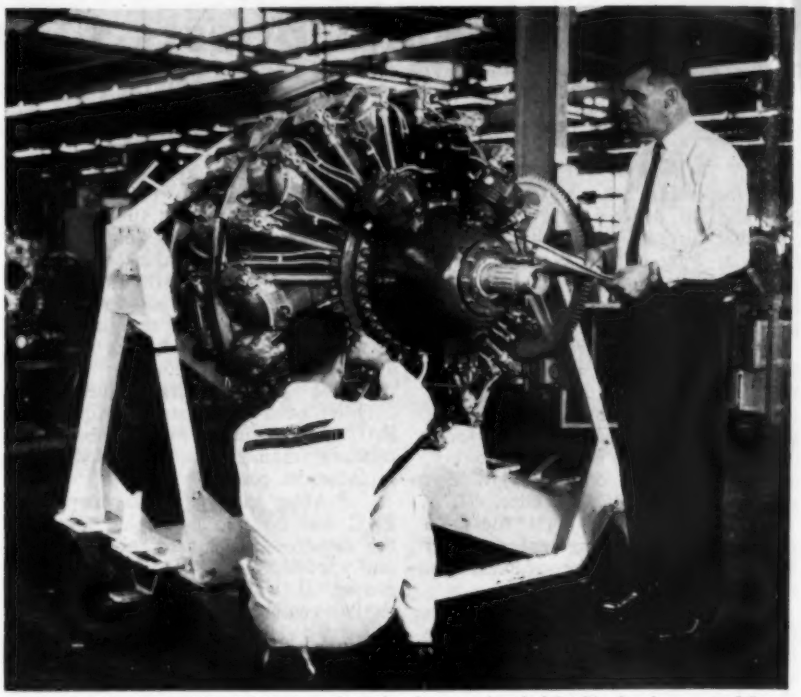
Develops More Horsepower

In full throttle (2,700 rpm and 54.8 HG) tests, the Super B developed more horsepower at takeoff settings than the other engine. The better engine performance, coupled with the improved ram provided by the Foundation's installation, results in sufficient additional power to permit an increase of 300 pounds in gross takeoff weight, according to a report by the Foundation.

At METO setting, the PAC engine consistently developed 20 more shaft horsepower than the conventional R-2800-B installed on the other side. PAC describes this as even more remarkable in view of the fact the Super B had 807.5 hours TSO at the time of this test phase compared to slightly over 200 hours for the -B engine.

At 700 hours TSO, the Foundation checked the rocker boxes and rear accessory section of the Super B for evidence of coke deposits and sludge normally present at this operating time. Internal conditions were found to be about the equivalent to that previously experienced in the conventional R2800-B with operating time of 100 hours or less.

• **When the Foundation** completed its tests, the Super B was using only .84 gallons of lubricating oil per hour, while the other engine, in spite of its lower operating time, was using 1.04 gallons per hour.



Engine Overhaul Specialist Ed Benkert (right), who spearheaded PAC's development of Super B engine, checks modified engine coming off final assembly at PAC's Burbank engine shop.

Depending upon quantity and customer requirements, PAC is offering Super B engines as low as $4500 with an acceptable exchange. "When compared with the cost of an R2800-C engine plus the additional price of $8000 for two replacement propellers for the later-type engine, the Super B offers substantial savings to C-46 operators," said Backman.

Meanwhile, PAC is proceeding with its development program to further improve C-46 power. Next step, according to Backman, will be modification of the R2800-C engine for use by those C-46 operators who require the additional power and can justify the increased cost. Two engines already have been test run in PAC's test cells and the results are said to be satisfactory. ◆◆◆

PAA Reported Ready To Order More Jets

Pan American World Airways, with $269 million in jet orders already on its books, may be in the market for additional big jets as well as short-to-medium range turbine transports.

In a recent Seattle speech, PAA v.p. Franklin Gledhill disclosed that the carrier holds an option on five more 707s in addition to the 23 on firm order.

He also indicated Pan American quite likely would buy more 707s or DC-8s, or both, if it is successful in route cases, currently pending before CAB.

Specifically Gledhill referred to applications for a "great circle" route to the Orient and the proposed Polar operation to Europe.

In the short/medium range field, the PAA official said the carrier has a need for up to 25 transports for Latin American routes.

Although he indicated Boeing's 727 is one of the types being considered, Gledhill said PAA has not yet decided between the jet and turboprop.

The PAA executive estimates the airline has until 1959 to make its final choice and that the new equipment would be required for introduction into service in 1963.

FLY PNA TO ALASKA
ANCHORAGE—ALASKA'S LARGEST CITY is just a few hours from Seattle by Pacific Northern 300 MPH Lockheed Constellation. Anchorage is famed for its proximity to so many areas of vacation enjoyment such as Bristol Bay and Kenai Peninsula, reached by PNA. Wherever you go in Alaska, make reservations with Pacific Northern Airlines, 1223 Seattle, Washington.
The Alaska Flag Line
PACIFIC NORTHERN AIRLINES
The Airline That Flies More Passengers In Alaska Service Than Any Other Airline

FLY TWA DIRECT

TO FABULOUS WINTER VACATIONLANDS!

Spend restful, sun-bathed hours at Phoenix, Tucson or Las Vegas. Flashing, action-packed moments on Denver's exhilarating ski slopes. Whatever your choice . . . TWA is the finest way to get there!

Fly in luxury! Travel First Class aboard TWA's great Skyliners . . . with every comfort . . . gracious service . . . delicious, full-course meals!

Save with TWA Sky Tourist! Fast, thrifty, low-fare service to holiday sun and fun. Enjoy deep-cushioned Constellation comfort . . . warm TWA hospitality!

Fly now . . . pay later, if you like, with TWA's liberal Time-Pay Plan. Only 10% down . . . up to 20 months to pay the balance!

Call your TWA travel agent or nearest TWA office today.

FLY THE FINEST

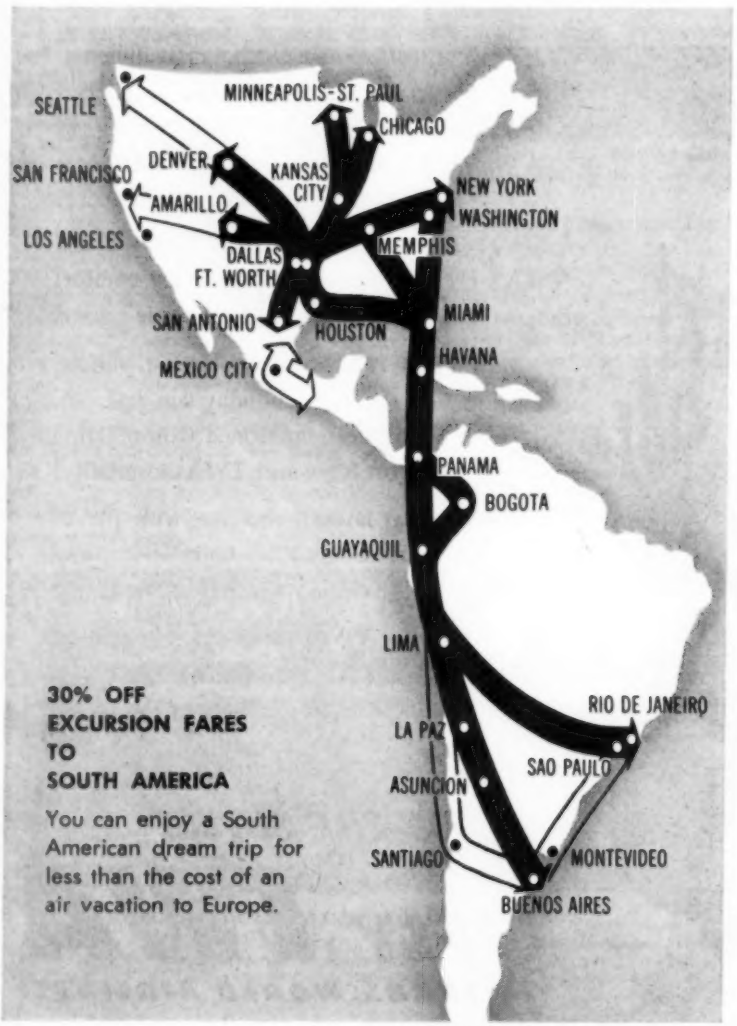
FLY TWA

TRANS WORLD AIRLINES

Only on

BRANIFF

can you enjoy the elegance of these distinctive flights . . .



30% OFF EXCURSION FARES TO SOUTH AMERICA

You can enjoy a South American dream trip for less than the cost of an air vacation to Europe.

El Dorado

- Braniff's fabulous version of the Douglas DC-7C — the world's fastest airliner — the only DC-7Cs in U. S. domestic service.
- New travel luxury . . . at no extra fare.
- Both first-class and aircoach accommodations.
- Equipped with RCA Radar—"sees" ahead 150 miles, guides flight to smoothest path.

Operating between

NEW YORK • WASHINGTON
DALLAS • CHICAGO
HOUSTON • SAN ANTONIO

EL NEW Conquistador

- Now faster, finer, more luxurious Braniff service between the U.S.A. and 10 Latin America cities.
- Both first-class and tourist accommodations.
- New soundproofing. Superb bilingual cabin service; master-chef meals; hospitality famed on two continents.

BRANIFF International AIRWAYS

Serving over 60 cities in the U.S.A. and South America • General Offices: Love Field, Dallas, Texas

Mohawk to Increase Seating Capacity Of Convair 240s to 46 Passengers

Mohawk Airlines will modify its fleet of 10 Convair 240s by increasing seating capacity of each plane from 40 to 46 and expects to boost its revenues substantially.

Terming it the "first major improvement in the Convair 240 since its introduction to scheduled airline service," Mohawk vice president Carl A. Benscoter said the increase will be accomplished with the same type seats now installed in the planes. High-density seating will be avoided by utilizing the weight allowance and space used by trunklines for buffet and cargo, he added.

• **The modification,** including installation of step-doors on the Convairs bought from Swissair last year, will be performed on five planes this winter and spring by AiResearch Aviation Service Co. at Los Angeles International Airport. Balance of the program will be conducted next winter.

Two seats will occupy the buffet area and two pairs of seats will be installed in the present position of the bulkhead between the passenger cabin and the carry-on luggage rack. The forward row of seats will face to the rear. The overall increase in seating capacity will be equivalent to one and one-half additional Convairs on Mohawk's system.

The 41st and 42nd seats were installed in one plane in August, and Benscoter said the effect of availability of more space was apparent almost immediately. Forty or more passengers were enplaned 31 times in August, 41 times in September and 80 in October. In July, 40 passengers were enplaned only nine times.

• **In the five months** to the end of the year, with one plane at 42 seats, the company experienced a revenue increase from this source of $4,704, Benscoter said, adding: "Projecting this experience to 10 planes at 42 seats for 12 months, we arrive at a revenue increase of $112,920. Increasing the capacity to 46 seats will produce a proportionate increase . . ."

Mohawk will be able to carry 15% more passengers, representing an increase of about 40¢ a mile in total revenue, with no increase in operating expense, according to Thomas J. Kirkup, v.p.-sales.

Two Airlines Buy Flight Simulators

New orders for flight simulators—one by American Airlines and another by Canadian Pacific Airlines—have launched two new firms in the commercial flight simulator business.

American Airlines placed a $1.8 million order with Erco Division, ACF Industries, Inc., for two units, one for the Lockheed Electra and another for the Boeing 707. AA order, first to be received by Erco, calls for 1958 delivery, well in advance of first receipt of the turboprops and jets by American.

One significant reason behind the selection of Erco, according to one AA official, is the mobility of its design. The Electra and 707 units will be housed in air-conditioned trailers for ease of transportation to any of its pilot training bases, according to American.

CPA's order calls for a single Douglas DC-6B simulator to be built by Canadian Aviation Electronics Co. and calls for delivery this summer. This unit is said to represent the first commercial flight simulator to be built in Canada and airline officials expect it will increase total effective training time by some 50%.

ODM Disallows $1 Billion in Tax Write-offs

Rapid tax write-offs for aircraft valued at well over $1 billion were left unauthorized when the Office of Defense Mobilization closed down the accelerated tax amortization program last December 31. Despite protests from all quarters of the industry, 16 U.S. airlines entered 1957 with 300-plus planes on which ODM had failed to grant rapid tax write-offs.

Following is a list of airlines with applications pending at the time of the rapid tax write-off shutdown:

Airline	Number and Type of Aircraft	Amount
Aerovias Sud Americana	1 DC-6	$ 1,500,000
American Airlines	30 707s; 3 DC-6As; 7 DC-7s	178,156,107
Braniff Airways	5 707s; 9 Electras; 5 CV-440s	50,990,000
Continental Air Lines	3 CV-440s; 12 Viscounts; 5 DC-7Bs; 4 B-707s	49,297,721
Delta Air Lines	8 CV-440s; 8 DC-8s; 10 Convair 880s	90,250,000
Eastern Air Lines	20 DC-8s; 20 CV-440s; 10 DC-7Bs	188,925,000
The Flying Tiger Line	10 L-1049Hs	19,500,000
National Airlines	6 CV-440s; 4 DC-7Bs; 6 DC-8s; 4 1049Hs; 23 Electras	112,725,213
Northeast Airlines	10 DC-6Bs	11,555,890
Northwest Airlines	6 DC-6Bs	9,300,000
Pan American World Airways	25 DC-8s; 22 B-707s	289,968,642
Pan American-Grace Airways	6 DC-7Bs; 4 DC-8s	39,925,000
Trans Caribbean Airways	4 DC-6As	4,508,390
Trans World Airlines	25 L-1649As; 8 L-1049Gs; 8 B-707s	140,200,000
United Air Lines	11 DC-7s; 30 DC-8s; 4 DC-6Bs	208,188,225
Western Air Lines	5 DC-6Bs; 9 Electras	28,491,000

Also denied by ODM was a Western Air Lines request for one Curtiss-Wright flight simulator for DC-6B, $754,000; and a request of Delta Air Lines for an engine overhaul building at Atlanta, $80,000.

CAA Orders Check On Lycoming Engines

Civil Aeronautics Administration has issued Airworthiness Directive No. 57-2-2 ordering special checks and placarding of Aero Commanders and Beech Models D50 and E50 fitted with Lycoming GO-480C and GSO-480A engines.

The CAA order, designed to combat engine failures caused by piston burning, calls for a special check before first flight subsequent to January 28 and at every 50-hour interval to insure the engine mixture control link is in "full rich" when the cockpit control is so positioned.

The directive also requires that all aircraft be prominently placarded to the effect that the carburetor mixture control must be kept in full rich under all operating conditions. Until further notice, manual leaning will not be permitted and the mixture control may be moved out of full rich only when stopping engines.

A third phase of the CAA order sets February 25 as the deadline by which aircraft must be flight-checked in level flight at 65% normal rated power to assure that fuel flows fall within Lycoming limits. Engines not meeting the limits will not be considered airworthy until necessary carburetor adjustment is made.

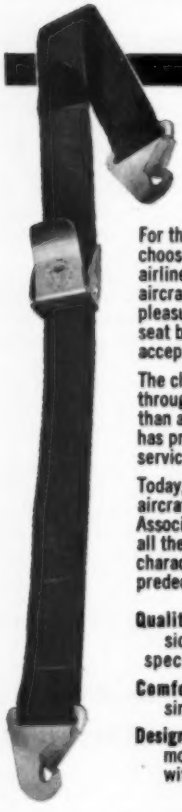
J. A. Collings Resigns As TWA Vice President

John A. Collings, who had been with TWA and predecessors since 1928, announced his resignation as executive vice president of the company.

Collings will continue on TWA's board of directors and will serve as senior consultant to the directors and to president Carter L. Burgess. He will devote "major attention to problems of the forthcoming jet age as they affect airline operations."

Widely known in the industry, Collings had served as TWA's acting chief executive officer last year.

AIRCRAFT SEAT BELTS TIME-TESTED BY MILLIONS



For the millions of people who choose swift, comfortable airline travel or pilot their own aircraft for business and pleasure, the Air Associates seat belt is a naturally accepted part of flying.

The choice of leading airlines throughout the world for more than a quarter-century, it has proven itself in unfailing service and superior design.

Today, the latest refinement in aircraft seat belts, Air Associates' M-7500, represents all the time-tested characteristics of its predecessors in:

Quality—high-strength, abrasion-resistant material of special nylon/rayon weave,

Comfort—plus foolproof and simple operation,

Design—handsomely styled, six modern colors, personalized with your own emblem.

WRITE FOR A CATALOG TODAY.

AIR ASSOCIATES, INC.

66 INDUSTRIAL AVE., TETERBORO, N. J.

BRANCHES: CHICAGO, GLENDALE, SAN FRANCISCO, DALLAS, MIAMI, ATLANTA, TETERBORO

Circle No. 27 on Reader Service Card.

Sam Saint Says . . .

Is SAGE the Answer for Air Traffic Control?

It is time for some plain talk on how the SAGE system of air defense relates to air traffic control.

The spotlight is about to swing from Tacan to SAGE. How to fit Tacan into the "Common System" has been one of aviation's nastiest headaches. But this may prove to have been only a practice run. The main event is coming up: SAGE, already a familiar word, threatens to produce the granddaddy of all aeronautical headaches.

Failure to integrate the military navigation system (Tacan) with the civil navigation system (VOR-DME) was a costly and time-consuming blunder. Many are jumping to the conclusion that the SAGE/ATC relationship presents a similar problem—that full integration is a must.

SAINT

Your reporter feels this hasty conclusion may not be justified. The arguments against full integration may far outweigh those in favor.

The SAGE air defense system is a colossus. When all the SAGE centers are in and operating, several thousand specially trained men will twist the knobs and scan the scopes of a three-billion-dollar network of wires and tubes and flying pulses. The phone bill alone for tying the parts of the monster together is expected to exceed a quarter-billion dollars a year.

In the oversimplified analysis that sometimes passes for top policy review, it would be easy to convince you that the air traffic control system should be fully integrated with SAGE. Both use radar. Both are concerned with everything that happens within the same air space. Defense must know what ATC is doing and vice versa. The simple answer, the obvious answer, however, may not be the right answer. There is urgent need to examine this whole matter from the users' and taxpayers' point of view.

Here are a few of the practical questions of operating practice and economy of airborne and ground equipment that should be considered now BEFORE several hundred million dollars have been turned into hardware—before cabinet-level face-saving becomes a problem:

• **The tremendous cost of SAGE** stems from three things: One, the need to be ready to do a fine grain job of meeting the enemy and eliminating same *anywhere within the entire cover area of the system.* In contrast, aircraft in the civil ATC system follow each other on the busiest airways, in peak hours of the day, at the most congested altitudes *an average of 150 to 200 miles apart.* The military has an obvious need for complete radar coverage. Only careless thinkers will claim this as an ATC requirement.

A second reason for the high cost of SAGE is that defense must deal with uncooperative aircraft. Question: Can we, in designing an ATC system, ignore the tremendous simplification possible by assuming that aircraft in the system will cooperate? Will fly the altitudes and routes assigned?

Third, SAGE is complicated and expensive because the detailed direction of air defense, for good and valid reasons, must be handled from a few large centers. Herein lies the quarter-billion yearly cost of phone lines. To say that air traffic control has the same requirement is to argue that the moment by moment (every sweep of a radar) separation of two aircraft over Plattsburg, N. Y., must be watched and controlled from the Boston Control Center 200 expensive phone miles away. This, from the cost point of view, is sheer madness.

• **Both operating sense and dollar logic,** on the other hand, dictate that air traffic control be run from smaller centers within radio line-of-sight of the aircraft involved. In an automatic system a few minutes per hour on a cheap, party-line teletype circuit can perform the necessary coordination between these smaller control centers.

By working within line of sight and assuming the cooperation of aircraft in the system, and by accepting lower tolerance in en route areas, the cost of the needed system may be reduced to one-fourth the cost of the SAGE approach. The seven years needed to apply the more complex SAGE techniques may be cut in half. Instead of costing more, two systems (defense and ATC, electronically married) may cost less than one for both jobs.

• **The big question** for a congressman, for a taxpayer, for an airline president worried about user charges for ATC: Should the ATC system be inseparably integrated with a military defense system that may be obsoleted by the ICBM before it becomes operational? Especially if the cost of the system could not be justified for ATC alone?

where did you see this girl?

Easy. She was in our national magazine advertisements.
She was surprised to see her boss *back so soon*
from a business trip. How did he do it? He followed The Hertz Idea:

Take a fast *plane* on your business trips. Then rent a bright, new
Powerglide Chevrolet Bel Air or other fine Hertz car *there*.

So what's in it for you?

Plenty. By encouraging people (millions of 'em) to leave their cars at home,
we encourage *more* airline passengers. *More profits* for you.
Naturally, we stand to gain, too.

So . . . let's work together. Mention the "idea" of renting a car
in your advertising! You can't lose! Hertz Rent A Car,
218 South Wabash Avenue, Chicago 4, Illinois.

More people by far...use
HERTZ
Rent a car

Allegheny, Mohawk Resume Merger Discussions

Merger talks are being held by Allegheny Airlines and Mohawk Airlines.

The two local service lines, which have informally discussed merger off and on during the past five years, have now assigned two members of each board of directors to carry on the discussions.

Also participating as a "neutral" representative is Alfred Saperston, Buffalo attorney with wide merger experience. He has been asked to study the companies and make recommendations as to how a merger can be consummated. As yet, no agreement has been reached.

Representing Allegheny are Henry A. Satterwhite, Bradford Publications Inc., Bradford, Pa., and Willard F. Rockwell Jr., president of Rockwell Mfg. Co., Pittsburgh. Mohawk directors are Paul A. Schoellkopf Jr., of Niagara Share Corp., Buffalo, and Charles N. Silcox, general manager of Cooperative G.L.F. Exchange, Ithaca.

R. L. Turner Resigns As Northeast V. P.

Robert L. Turner, vice president-traffic and sales of Northeast Airlines for six years, has announced his resignation from the company. He did not reveal future plans. George Gardner, Northeast president, said the directors accepted the resignation "with great regret."

To take over Turner's responsibilities, Gardner announced three immediate promotions: Paul V. McPeake moved up from director of stations to director of customer services, Edwin W. Breed from general sales manager to director of sales, and Charles H. McKenney from traffic manager to director of traffic.

Northeast's board elected Robert H. Kerr, personnel director, to the newly-created post of v.p.-personnel.

CAB Lifts Restrictions

CAB removed restrictions from certificates of American, TWA and United that prohibited off-route stops for non-traffic purposes. The airlines were previously barred from making operational stops at off-route points except in emergency cases. Affected are American's routes 4, 7 and 25; TWA's route 2, and UAL's route 1. CAB majority also ruled out an argument that specific authority is needed for off-route stops.

PAA To Open New Route

Pan American World Airways plans to open New York-Nassau service on Feb. 21 when the certificate for the recently-authorized route becomes effective.

Decentralization of Authority Will Be Main Feature of TWA 'New Look'

A new organization plan that will feature greater decentralization of authority is in the works for TWA.

In his first statement to a meeting of management personnel, TWA's new president Carter L. Burgess also said the company must create a "new look" in service.

"What I have to say is based on two major assumptions: (1) TWA has not been doing well, and (2) TWA had better do something about it *now*," he told the meeting.

A main feature of the new "efficient organization plan" will be "greater decentralization with more authority and responsibility in the field," he added.

"One of the difficulties we have to overcome is the long, thin 'giraffe's neck' line of communications to the man in the field and the long, dusty throat-line back on necessary decisions. We must develop the use of good judgment in the field. Referrals to higher authority shall be restricted to items that fall outside established responsibilities . . .

"We will set up in New York an operations and briefing room. This will function 24 hours a day. It will be the nerve center of the system, recording our successes and failures almost as soon as they occur. When I check into this office at any hour of the day or night it will be possible to learn exactly how well the system is functioning at every point, and in each department . . .

"We will install performance and cost standards for departments, for regions and for individuals. The new planning department will assist in laying out long-range plans so we will all know where we are headed. I am interested also in sound development of executive personnel and adhere to the principle of sensible rotation to provide broader experience."

Burgess said, "I would rather be president of the best airline in the business than to be known as the best president in the business, but heading a second-rate airline."

Discussing a "new look" for TWA, Burgess said that "we must strive for and attain better dependability of service, more attentive passenger-handling, scheduling that conforms more closely to the needs of the traveling public, greater economy of operations and more ingenious methods of merchandising our product."

AA, EAL Win Rights To N.Y.-St. Louis Nonstop

St. Louis-New York nonstop service by American Airlines and Eastern Air Lines has been authorized by CAB in a press release decision. TWA is presently the only nonstop operator on the route.

Authorizations will be accomplished by consolidation of EAL's routes 47 and 5, and extension of AA's route 25 from St. Louis to Cincinnati.

CAB also voted to restrict AA from providing single-plane service between St. Louis and Washington-Baltimore-Philadelphia; voted to lift the restriction on AA to permit Louisville-Washington nonstop; denied AA's application to extend route 4 from St. Louis to Cincinnati.

EAL was restricted from operating nonstop between New York and Charleston, W. Va., and its application to serve Cincinnati on the St. Louis-New York route was denied.

TWA's restriction was removed to allow Louisville-Washington nonstops.

World Airlines Traffic Set New Records in '56

International Civil Aviation Organization estimates show the world's airlines (excluding Russia and Red China) flew 78 million passengers a total of 45 billion passenger-miles in 1956. ICAO estimates total passengers will reach 100 million by 1958. Here's organization's year-by-year compilation since 1945.

Year	Miles Flown	Hours Flown	Passengers Carried	Passenger Miles	CARGO Ton Miles (Millions)	MAIL Ton Miles
1956	1,630	8.2	78	45,000	1,030	280
1955	1,440	7.4	68	39,000	910	260
1954	1,290	6.7	58	33,000	770	230
1953	1,200	6.4	52	29,000	720	190
1952	1,100	6.0	46	25,000	680	180
1951	1,010	5.6	42	22,000	640	170
1950	890	5.0	31	17,000	530	140
1949	840	4.8	27	15,000	390	130
1948	790	4.6	24	13,000	290	120
1947	710	4.2	21	12,000	180	90
1946	580	3.8	18	10,000	80	70
1945	370	2.5	9	5,000	70	90

Airline Commentary

By Eric Bramley

Big question these days is whether domestic airlines will be able to agree on a no-show penalty plan. And your guess is as good as anyone's. The January meeting of the Air Traffic Conference failed. The next session is in April. Weighing the scales against an agreement is the fact that some airlines hold the firm conviction that there should not be a penalty of any kind. Also there are some who are still rankled because the reconfirmation rule was rescinded. They think it should be reinstated, and they're not inclined to vote for anything else. Others are equally opposed to reconfirmation and insist a penalty is the answer. Bright spot may be the fact that the ATC group that's trying to resolve the differences and come up with an acceptable plan is headed by National Airlines vice president Walt Sternberg. In the past Walt has been successful in resolving disputes both in IATA and ATC. We wish him luck on this one.

* * *

Some idea of the size of current airline promotional activities is seen in Pan American World Airways' statement that this year it has distributed over 1,000,000 *calendars. This is the most widely distributed industrial calendar in the world and by far the largest in the travel field, PAA says.*

* * *

Comment on railroad passenger service: It's currently being conducted "with a car fleet with an average age of nearly 30 years; there is little promise that the volume of car deliveries during 1957 will do much to keep this fleet from growing a year older." So says *Railway Age* magazine, which adds: "There is no apparent general solution for this most vexing (passenger service) problem. A lack of agreement between the various railroads and frequently poor presentation of the facts about passenger operations have done much to produce apathy and outright antagonism among the customers."

* * *

Comment on airline passenger service, by TWA's new president, Carter Burgess: "Nothing you can suggest will have more beneficial effect than good old-fashioned thoughtfulness and courtesy on an unfailing and consistent basis—the act of doing the little things of life well."

* * *

The following anonymous message appeared recently on an airline teletype during a slack period: "Drive safely—the life you save may be your relief."

* * *

Paperwork really adds up in the airline business these days. Capital Airlines sold a DC-4 to Mackey Airlines, and the plane had 893 pounds of ship's logs and records aboard.

Sales, Traffic, Promotion

Three major airlines have announced 1957 sales goals: **Pan American World Airways** is aiming for $330,552,000, up 11.3% from 1956; **American Airlines'** goal is more than $330 million ($291,452,866 from all sources last year); **Eastern** wants 9 million passengers and $270 million revenue, against 7.7 million passengers and $235 million revenue in 1956 . . .

Pan American will support its 1957 sales program with a record $9 million advertising budget. Ads will stress PAA's performance, experience, reliability, courtesy and leadership. Company will also increase U.S. sales offices: Dallas and Pittsburgh move up from branch office to district office status; Hartford becomes a branch office; plans are being completed for offices in Baltimore and Montreal; surveys are being made in Kansas City, Memphis, Milwaukee and Indianapolis . . .

America's ads will emphasize its expanded deluxe Mercury service. In addition to newspaper and radio spot campaigns announcing Mercury expansion, AA will have nine four-color spreads in the *Saturday Evening Post* . . . AA is now providing a buttonhole in the linen napkin served with your meal tray. A card on the tray explains: "It is quite permissible, in the highest sky society, to shield clothing from unexpected spills by fastening the napkin to the highest button while dining above the clouds." A smart idea . . .

Equipment that permits in-flight brewing of coffee is being installed by **United Air Lines** in its DC-7s and DC-6s. Coffee is brewed 11 cups at a time. Equipment was manufactured by Nordskog Co., Van Nuys, Calif. **TWA** recently installed coffee-brewing equipment developed by Huggins-Young Coffee Co., Los Angeles . . . United has revised the format of its company publication and has changed the name from the *News* to *The Shield* . . .

A new vacation savings plan has been launched by **Industrial Federal Savings Bank,** Denver, in conjunction with six airlines serving the city. The program, a version of the Christmas savings club plan, features six all-expense air strips toward which the bank's customers can save a specified amount each month—a pay-first-go-later deal . . .

Northeast Airlines is installing a ticketing device at major stations. Machines are made by Addressograph-Multigraph Co. Each machine has a file of addressograph plates which contain fares, routings and class of service information that can be imprinted on the basic one, two- and four-coupon passenger tickets. Plates will be provided initially at major stations for all on-line destinations; interline destinations will be added later. New device eliminates necessity of having numerous preprints, Northeast says . . .

Western Air Lines and six Las Vegas hotels have renewed their midweek vacation promotion, "Show-time Holiday." Vacationer is offered three days and two nights at the Flamingo, New Frontier, El Rancho Vegas, Riviera, Sahara or Tropicana, plus some meals, two evening shows and other extras. Price is $30 plus air fare and is good between Mondays and Fridays . . . Western has opened its fifth annual promotion campaign to acquaint residents of 13 of its northern cities with the advantages of a winter vacation in the "sun country." Campaign is conducted in cooperation with Sunkist Growers Inc. . . .

TWA is distributing 15,000 copies of its complimentary "Guide to Hotel Facilities for Business Meetings and Conventions." Guide lists by states and cities the hotels available for meetings, names of hotel officials, number and capacity of accommodations by individual rooms, suites, meeting and banquet rooms, rates, exhibit space, etc. . . . A new booklet, "The World Is Yours," outlines TWA's 1957 travel and study tours for students and teachers. Company says that when it started these tours in 1949, only 42 students and teachers responded. Last summer, 2,430 were carried, comprising 18% of all TWA's overseas business . . .

Capital Airlines on Feb. 1 increased from seven to nine the number of Viscount nonstop flights between Washington and Chicago. It also put Viscounts on the Washington - Greensboro - Knoxville-Memphis route for the first time, one flight daily . . . Capital has opened a reservations-sales office on the first floor of the Lutheran Brotherhood Bldg., 7th St. and Second Ave., Minneapolis . . . Northwest Airlines has replaced DC-4s with DC-6Bs on Tokyo-Hong Kong and Tokyo-Seoul routes. . . .

New lightweight aluminum-and-fibreglass baggage carts are being introduced by United Air Lines at major terminals and will eventually replace all steel carts on the system. Manufactured in three sizes with weights of 400, 550 and 600 lbs., the carts are said to be 50% lighter than comparable steel models. Advantages cited by United include: the fibreglass floor cannot bend or warp; the cart requires no painting and is rust-proof; it is more maneuverable. New vehicle was developed in conjunction with Harbo Division of Service Metal Fabricators Co., Santa Monica, Calif.

THE BULLETIN BOARD

Undisplayed Advertising: $1.50 per line, minimum charge $4.50. Cash with order. Estimate 30 capital letters and spaces per line; 40 small lower-case letters and spaces per line. Add two lines if Box Number is included in lieu of advertiser's name and address. **Displayed Advertising:** $18.00 per column inch. Space units up to full page acepted in this section for classified-type advertising. Forms close three weeks preceding date of issue. Address all correspondence to Classified Advertising Department, American Aviation Publications, 1001 Vermont Ave., N. W., Washington 5, D. C.

Help Wanted

WANTED: Professional Flight Instructors with extensive experience instructing in multi-engine aircraft; also Link and simulator operators. Send complete resume. Information will be kept confidential. Box 100, AMERICAN AVIATION Magazine, 1001 Vermont Ave., N. W., Washington 5, D. C.

Situations Wanted

ATR Pilot: SEL-MEL-DC3 Type rating, Instructor, A&E mechanic. 7,000 hrs. 3,000 hrs. Mel. 420 hrs. actual instrument. Airline Capt. & executive experience. Age 33, married, two children. All ratings current. Available immediately. H. Johnson, RI Box 328, Benton Harbor, Michigan.

HELP WANTED

AIRPORT DIRECTOR—General Mitchell Air Feld $756.59 to $908.78 per month. College graduate preferred; specialization in business administration, aeronautical or civil engineering desirable. Five years' responsible experience in airport administration or management. Examination open to citizens of United States over 21 and under 55 years of age. The county maintains a sound annuity and pension system for those who qualify therefor. Applications must be filed before 4:00 P. M., March 8, 1957. Write to:
MILWAUKEE COUNTY CIVIL SERVICE COMMISSION
Room 206, Courthouse
Milwaukee 3, Wisconsin

Remmert-Werner

Inc. of	Inc. of	Inc. of
St. Louis	**Florida**	**Toledo**
Lambert Field	Pompano Beach	Express Airport

Lodestar **DC3** **Beech**

Specialists in Conversion, Maintenance, Overhaul

OXYGEN EQUIPMENT
SALES & SERVICE
REGULATORS—MASKS—VALVES
PORTABLES & CYLINDERS
FIXED INSTALLATIONS
GOV'T APPROVED REPAIR STATION
ZEPAERO Phone: ORegon 8-1181 EL SEGUNDO, CALIFORNIA

WORLD'S FOREMOST
LODESTAR
SERVICE CENTER

Inspection	Radar
Maintenance	Interiors
Instrumentation	Engine Change
Modification	Exteriors
Overhaul	Radio

PacAero Engineering Corp.
(Formerly Lear Aircraft Engineering Division)
Santa Monica Airport, Santa Monica, California
Builders of the Incomparable Learstars

for sale

3
C-46 F's

Excellent operating condition. 48,000 lbs. gross cargo capacity. Radio equipped—receivers (including glide path), transmitters, power supply, modulator, antenna relay, jack boxes. Natural finish, white top. P & W R-2800-75 engines. Fuel capacity, 1340 gal. Wing and prop de-icers. Outright sale or year's lease subject to bank approval.

SLICK AIRWAYS, INC.
3415 Cedar Springs Road
Dallas, Texas

GRUMMAN MALLARD J-29
Now being overhauled. Will finish to specifications.

1946 BEECHCRAFT D-18S
Clean and ready to go—$34,750.

WILLIAM C. WOLD ASSOCIATES
Dept. AA—551 Fifth Avenue
N. Y. 17, N. Y.
Telephone: MUrray Hill 7-2050
Cable: Billwold

HANGARS
We engineer, furnish and construct all-steel hangars to suit every requirement. Long-span, low-cost hangars are our specialty. Immediate delivery in most sizes. Photos and specifications on request.
ANDERSON STRUCTURAL STEEL CO.
1700 Sawtelle Blvd., Los Angeles 25, Calif.

NAVCO inc. Lambert Field St. Louis, Mo. PErshing 1-1710
has in stock
A.B.C. - Bendix - Collins
Sperry - Wilcox
Executive Aircraft Radio

Washington Representative
Government-Tariffs-Rates
EASTERN TARIFF BUREAU
International Bldg.
Wash. 4, D. C., District 7-4922

Immediate Delivery
We stock, overhaul, and install

WRIGHT	PRATT & WHITNEY
R1820 -202, -56, -72	**R1830** -75, -92, -94

R2000 **R1340** **R985**

and our most popular DC3 engine
R1830 - SUPER - 92

ENGINE WORKS
Lambert Field Inc. St. Louis, Mo.

DC-4's
Cargo or Passenger
Heavy Floor and Cargo Door
R-2000-9M2—Engines
2876 Gal. Gasoline
Complete Radio Equipment
70 Passenger
Ready to Go
Contact Thomas Millstein
NATIONAL SURPLUS SALES CO.
1800-14 Charlotte
Kansas City, Mo.

Now Appearing in The February Issue

Missiles and Rockets

Magazine of World Astronautics

★ ★ ★ ★

Uncovering
Soviet
Satellites and
Rockets

★ ★ ★ ★

Subscription rates: 1 year $8, 2 years $12. (U.S.A., Canada). Overseas: 1 year $9, 2 yrs. $14. Order from Substription Dept. MISSILES & ROCKETS 1001 Vermont Avenue, N.W., Washington 5, D.C.

This is NOT a C-46*

*It's a CW20-T

• The future of your C-46 is **in your hands** because your aircraft can now be completely remanufactured into a FULLY CERTIFIED CW20-T... with faster speed, greater payload capacity, a much higher degree of safety and more economical operation. Approved by Civil Aeronautics Administration for all passenger and cargo operations of scheduled airlines in the United States.

Only the L.B. Smith Aircraft Corporation is certified by the C.A.A. to remanufacture your C-46 to Transport Category Specifications.

Financing available, of course.

L. B. Smith AIRCRAFT CORPORATION

Call, write or wire:
L. B. SMITH AIRCRAFT
Aircraft Sales Dept.
International Airport
Miami 48, Fla.

Shown seated above is K. W. Goebel, Rohr Design Engineering Manager

DESIGN ENGINEERS
find quick recognition of ability at Rohr

Every engineer at Rohr works closely with interested associates—and management. He finds respect for his ideas—swift recognition for his talent. He finds a big job and a big future in the tremendous field of power packages—a field in which Rohr is the accepted world leader. He finds Rohr a *real working company*—with *no absentee management.* He finds job permanence and stability assured by long-range projects (current backlog—$200,000,000—40% of which is commercial.)

And at Rohr, the engineer and his family find new, happier, year-round living in sunny Southern California.

If you are a skilled production design engineer, write Rohr now! Enclose resume to J. L. Hobel, Industrial Relations Manager, Dept. 101

World's Largest Producer of Ready-to-Install Power Packages for Airplanes

ROHR AIRCRAFT CORPORATION

In beautiful, sunny Chula Vista, California

The blue cold above the troposphere is simulated in a ground level laboratory.

Feet-on-the-ground engineers...at 60,000 feet

Research Engineers don't have to fly to the stratosphere to conduct high altitude tests at North American's Columbus Division. The bone-chilling conditions are simulated right here, in one of the laboratories of our completely equipped Engineering Department.

At the present time, the expanding work of this Department is creating unusual opportunities for you if you are an engineer with a career to make in the aviation industry. Facilities are among the finest anywhere. They include a fine new air-conditioned engineering building and 16 completely equipped laboratories, designed to enable creative engineers to carry out experiments, studies and development of their ideas.

The Columbus Division has prime responsibility for all North American Naval aircraft projects from concept through flight. Recognition is rapid for men who want to make their own way through their own ability. You should certainly investigate the opportunities here in your field.

PROMISING POSITIONS ARE OPEN IN EVERY FIELD:

Aerodynamicists, Thermodynamicists, Dynamicists, Stress Engineers, Structural Test Engineers, Flight Test Engineers, Mechanical and Structural Designers, Electrical and Electronic Engineers, Wind Tunnel Model Designers and Builders, Research and Development Engineers, Power Plant Engineers, Weight Engineers.

Write for the full story: Mr. J. H. Papin, Personnel Manager, Dept. **562-A,** North American's Columbus Division, Columbus 16, Ohio.

THE COLUMBUS DIVISION OF

NORTH AMERICAN AVIATION, INC.

ADVERTISERS' INDEX

Aero Design & Engineering Co. 75
Air Associates, Inc. 100
AiResearch Manufacturing Co.,
Div. of The Garrett Corporation ..... 78 & 79
Alpha Molykote Corp., The 66
American Airlines, Inc. 92
Avien, Inc. 49
B & H Instrument Company 64
Babb Company, Inc., The 83
Beech Aircraft Corp. 80
Bell Aircraft Corp. 16
Bendix Aviation Corp.,
Bendix Products Div. 18
Bendix Radio Div. 6
Scintilla Div. 69
Blythe Aircraft Corp. 14
Boeing Airplane Company 58
Braniff International Airways, Inc. 98
Bulletin Board (Classified) ..... 104 & 105
Cee-Bee Chemical Company, Inc. 73
Champion Spark Plug Co. ..... 87 to 90
Chance Vought Aircraft, Inc. ..... 56 & 57
Commonwealth of Pennsylvania,
Industrial Development Div. 42
Continental Aviation & Engineering Corp.,
Sub. of Continental Motors Corp. 43
Continental Motors Corp.,
Aircraft Engine Div. 61
CONVAIR—a Division of General Dynamics Corp. 27
Cooper Precision Products 11
Curtiss-Wright Corp. 34

EMPLOYMENT SECTION

McDonnell Aircraft Corp. 107
North American Aviation, Inc.,
Columbus Division 106
Rohr Aircraft Corp. 105
Esso Export Corp. 10
Fairchild Engine & Airplane Corp.,
Aircraft Division 109
Flightex Fabrics, Inc. 82
Ford Instrument Co.,
Div.—Sperry Rand Corp. 19
G. M. Giannini & Co., Inc. 8
B. F. Goodrich Aviation Products,
a Div. of The B. F. Goodrich Company 28
Goodyear Tire & Rubber Co., Inc., The 3
Hertz System, Inc. 101
Hi-Shear Rivet Tool Company 4
Hollywood Roosevelt Hotel 14
Hoover Electronics Company 76
Indiana Gear Works, Inc. 71
Janitrol Aircraft-Automotive Div.,
Surface Combustion Corp. 7
Joy Manufacturing Company 62
Kelsey-Hayes Wheel Company 84
Hotel Lexington 40
M. C. Manufacturing Company 12
Marman Products Co., Inc.,
a Sub. of Aeroquip Corp. 45
Minneapolis-Honeywell Regulator Co.,
Aeronautical Div. ..... 24 & 25
McDonnell Aircraft Corp. 41
Narmco Resins & Coatings Co. 68
National Aeronautical Corp. (NARCO) 14
Orenda Engines Limited 1
John Oster Manufacturing Co.,
Avionic Division 72
Pacific Northern Airlines, Inc. 96
Pratt & Whitney Aircraft Div.,
United Aircraft Corp. ..... 54 & 55
Puritan Compressed Gas Corp. 14
Robinson Aviation, Inc. 46
Ralph C. Robinson Company 74
Simplex Piston Ring Manufacturing Co. 52
Solar Aircraft Company 67
Southwest Airmotive Co. 13
Sperry Gyroscope Company,
Div. of Sperry Rand Corp. 15
Standard Factors Corp. 70
Stratos,
a Div. Fairchild Engine & Airplane Corp. 77
Technical Development Co. 66
Texas Company, The 110
Trans World Airlines, Inc. 97
United Air Lines, Inc. 50
Vickers Incorporated 65
Wilcox Electric Company, Inc. 2
Winslow Manufacturing Company 5

Contracts

Commerce Dept. announced the following USAF contract awards:

Convair, San Diego, $20,634,869, F-106A interceptors; $1,000,000, F-106B tandem-seat version.

Erco Div., ACF Industries, Hyattsville, Md., $3,487,023, KC-135 simulators.

Allis Chalmers Mfg. Co., Terre Haute, Ind., $2,000,000, facilities for production of J79 engines.

Douglas Aircraft Co., Santa Monica, Calif., three contracts totaling $2,340,083, facilities for WS-315A Thor mid-range ballistic missile.

Hughes Aircraft Co., Culver City, Calif., $1,670,000, MA-1 interceptor and weapon control system.

Westinghouse Electric Corp., Dayton, O., $2,509,326, generators, regulators and other equipment for B-52.

Thiokol Chemical Corp., Elkton, Md., $1,520,527, M-58 rocket engines for Falcon missiles.

Ford Instrument Div., Sperry-Rand Corp., Long Island, N. Y., $15,299,725, latitude-longitude and magnetic variation computers.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., $9,438,916, MB-3 components for F-100D aircraft.

Utica-Bend Corp., Utica, Mich., $1,300,000, acquisition and installation of machinery for overhaul of J47 engines.

Sperry Gyroscope Div., Sperry-Rand Corp., Great Neck, N. Y., $6,471,402, receiver-transmitters and other equipment.

Stewart-Warner Corp., Chicago, $4,844,794, coder, transponder and receiver-transmitters.

Radio Corp. of America, Camden, N. J., $3,092,764, fire control system, receivers and automatic flight controls.

EMPLOYMENT

AERODYNAMICISTS

FOR

AIRPLANES • HELICOPTERS • MISSILES

We have a variety of stimulating assignments for experienced Aerodynamists—your choice of airplane, helicopter, convertiplane, or missile development projects. Also needed are Wind Tunnel Test Engineers for work in our own low-speed wind tunnel and at other test facilities.

Continue your professional development on our new $6,000,000 "Engineering Campus." Opportunities for advanced engineering education. Responsibilities and remuneration to match your experience background.

For qualified applicants, interviews can be arranged at your convenience—either in your city or at the McDonnell plant. Moving allowances and assistance from our Housing Department upon arrival in St. Louis. If interested, send detailed experience resume to:

RAYMOND F. KALETTA
TECHNICAL PLACEMENT SUPERVISOR
P. O. BOX 516, ST. LOUIS 3, MISSOURI

McDONNELL Aircraft Corporation

Even in the Congo, U.S. Products Abound

Big game hunter and explorer that I am, I went to the Belgian Congo last summer without a hat. I wanted to be outfitted for the safari on the spot. Real native stuff. If it was a sun helmet I needed, okay.

So in Leopoldville I went shopping. I discovered that sun helmets are common enough but that I'd look like a tourist for sure if I wore one. I learned that the most popular and usable hat to wear was a crushable water-proof job made of a nylon combination. I bought one. Where do you suppose it was made? In the U.S.A., by Burlington Mills.

That's typical of the Congo. Because of a big dollar balance, the Congo buys a great amount of stuff from the U.S. You'll find just about every kind of American product made. The shops are well filled. Coca Cola and Ford and Palmolive signs abound.

Leo is having quite a boom. There are quite a few new modern office buildings, mostly of three to six stories, and new apartment houses, and vast housing developments for the influx of natives from the jungle. There are wide avenues and parkways, and everybody drives like mad, just as the Belgians do in their homeland.

Mosquito control has been truly remarkable. Every six months the area is sprayed. I never felt or heard a mosquito in Leo. But flies are terrific pests and haven't yet been controlled. It's always hot and humid there but if you're lucky you'll have an air-conditioned room.

Many Americans and Europeans have built nice homes on a series of ridges about a dozen miles south of the town. Much cooler out there, especially at night.

Mighty Big River

If you have a yen for big rivers, the Congo is your meat. It is navigable for 1,979 miles above Leo but the entire navigable river system comprises 7,902 miles. You can take a steamer on regular schedule to a great many points in the vast Congo basin. You either fly or go by river into the interior. The main road system is far back.

The port of Leo is one of the most interesting in the world because it's a river port 200 miles inland from the ocean. The big rapids just below Leo prohibit water transportation from the sea so everything has to be transhipped from the seaport of Matadi by rail to Leo and then reloaded onto river boats. Oil is brought up by pipeline.

The Congo is the fifth largest river in the world, extending 2,718 miles in its entirety. The Nile is the longest, 4,163 miles, followed by the Mississippi with 3,989, the Amazon with 3,915 and then the Yangtze with 3,156.

But if the Congo is fifth in length, it must easily be first in volume of water. Its flow varies from 30,000 to 98,000 cubic yards per second. Its volume is 168 times that of the Meuse at Liege. It draws from a basin of 1,457,783 square miles and the hydraulic energy available in this basin at lowest water levels is estimated at 130 million horsepower, or one-fifth of the potential power of the entire world.

I got two good views of this massive water movement at Leo where the river is at least five miles wide. John J. Nelson, district sales manager for Pan American at Leo (who kindly assisted me in many ways), hired a motor launch to take me for a complete view of the port area and across the river to Brazzaville on the French side. The river is an awesome sight and the current fast and powerful. You're okay as long as the boat engine keeps going. I sure wouldn't want to tangle with those rapids where the waves pile up to as much as fifteen feet in height.

Flying Over the Rapids

A real thrill was provided by Major Gaston Dieu, then the Congo manager for Sabena, who has now moved up the executive ladder at Sabena headquarters in Brussels. He flew me over the rapids in a Sikorsky S-55 helicopter and all I can say is that I prayed for the continued success and reliability of Sikorsky Aircraft as we passed over the terrifying sight of that tremendous volume of water tumbling down the decline. Major Dieu is an excellent pilot who flies everything from copters to DC-6Bs.

We landed the S-55 at Brazzaville airport just behind a KLM Super-Constallation and found a completely different atmosphere on the French side. The town is declining rather than booming and is typically Colonial French. We drove to a fine restaurant called Relais, originally built by Air France and now operated by a concessionaire, and had lunch on a terrace overlooking the river with Leo far in the background. The food was excellent. Adjoining the main building are cottages used mostly by air travelers making connections with the extensive network of local routes in French Africa.

If you're planning a trip to the Congo, count on rain at some point. Rainfall ranges up to as much as 78 inches a year, although on my trip we had very little at any time. One section of the Congo has its "dry" season while another has its "wet" season, so any trip in the interior involves rain at some time. The climate is always good.

I can recommend Mr. J. M. Ingels and his L'Auto Africaine, Stanleyville, as a first-class outfit for supplying cars and drivers for your safari.

And the Tourist Bureau for the Belgian Congo & Ruanda-Ruindi has just issued the second edition in English of a very excellent Travelers' Guide. It's a detailed description and guide to the Congo, a "must." Can be obtained through the Belgian tourist bureau in New York (720 Fifth Avenue), or in Brussels.

There is a fair amount of private flying in the Congo with a total of 56 private and club-owned airplanes now operating. Of these 56, 26 are Pipers but there are some other American types such as Cessnas, Beeches and Ercoupes, while the remainder are British types.

Up at Bukavu I met Paul C. Goffin, who is one of the officers of the Aeroclub du Kivu, which flies a Piper, and he asked me if I could get him information about aero clubs in the U.S. So anyone who would like to help him out, please write to him at the Aeroclub du Kivu, B.P. 1001, Bukavu, Belgian Congo. Can Piper help out?

New Airport Being Built

A big new airport with 10,000-ft. runways, longest in Africa, is being built south of Leo in anticipation of the jet age. Sabena will be flying Boeing 707s to the Congo from Brussels.

I spent some time with a long-time aviation representative in the Congo well-known to many American firms—Frederic Meeus, whose Intair firm handles such American products as Sikorsky, Beech, Radioplane, Bendix, Sperry and Esso. Meeus and his sidekick, Pete Naus, know the Congo intimately. Meeus has done very well in the aircraft brokerage business, makes regular trips to the U.S., and is the Congo anchor for the Intair Company in Brussels.

I'll wind up the Congo series next issue with some data about how important aviation is to that part of the world and tell you about my trip back to Brussels via Geneva.

The C-123 can't stop on a dime—

but it can land in 700 feet!

Meet the most agile, the most sure-footed transport in the world – the Fairchild C-123. It is capable of air-lifting up to 60 troops, or up to eight tons of bulk combat cargo – and it needs no mile-long concrete runway.

Almost any clearing, almost any field is a potential C-123 airbase; even deeply rutted, ungraded, or sandy grounds are taken in stride by this rugged ship. And sophisticated aerodynamic design makes possible a landing run of only 700 feet—a takeoff run only a little longer.

Performance, ruggedness, payload and versatility . . . these are traditional hallmarks of Fairchild aircraft.

FAIRCHILD

AIRCRAFT DIVISION • HAGERSTOWN 10, MARYLAND

A Division of Fairchild Engine and Airplane Corporation

...WHERE THE FUTURE IS MEASURED IN LIGHT-YEARS!

Executive interior of Douglas DC-3
by Aero Corporation, Atlanta, Ga.

AIRBORNE OFFICE

..... and a word to the man who will occupy it

EXECUTIVES who travel in corporate aircraft find eminent satisfaction in their reliance on Texaco. Fixed base operators who handle Texaco put great emphasis on quick, courteous and competent service. They maintain complete mechanical facilities and provide a host of conveniences to make stop-overs pleasurable experiences.

Then, of course, there is the unfailing dependability of Texaco Aviation Products, as evidenced, for example, by the fact that—

During the past 20 years, more scheduled revenue airline miles in the U. S. have been flown with Texaco Aircraft Engine Oil than with all other brands combined.

If you fly for business, let Texaco help keep you on schedule. If you're a fixed base operator, let Texaco help your business grow. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, *Aviation Division,* 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Lubricants and Fuels
FOR THE AVIATION INDUSTRY

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Circle No. 28 on Reader Service Card.